

# Aviation Week

*Including Space Technology*

October 6, 1958

**Boeing 707  
Pilot Report**

**IRBM Engines'  
Assembly Detail**

75 Cents

A McGraw-Hill Publication

**Chance Vought Regulus II  
Fired From Submarine**



Many of the components, instruments and systems in use on our IHV's and RCBM's were designed, developed and built by Rheem Electronics. With a history of proven performance in advanced aircraft and guided missiles, Rheem's ruggedized and retooled airborne products are now standing up to the tough environmental conditions of intercontinental ballistic travel.

Other Rheem systems include ground test and preflight checkout equipment, flight safety and test instrumentation, trainer simulators, countermeasure systems, and industrial test and processing equipment.

For proven reliability, look for leadership in Rheem Electronics... a division of world-wide Rheem Manufacturing Company, which operates 17 plants in the United States and, with affiliated and associated companies, 18 plants in 12 countries abroad.

For a full description of Rheem Electronics, write for Data File AF-506-1.

## AIRBORNE ELECTRONICS



**RHEEM MANUFACTURING COMPANY / ELECTRONICS DIVISION**

9770 Industry Avenue, Irvine, California — Plant #Approved 4-9071

When the demand is for motion...

The power thrust—the secret thrust—the most quiet—these are the critical considerations when the demand is for motion in an extreme control. Of equal importance is the choice of a power source: pneumatic, hydraulic, electric, or mechanical.

Since 1945 Hydro-Aire has met the most exacting conditions in each of these categories. From pneumatically operated jet engine accessories to electro-mechanical actuators, from electric motors to turbine accessory drives, from the sheer simplicity of a manually operated ball valve to the complex system knowledge in an automatic landing system.

When your demand is for tomorrow's airwing package, Hydro-Aire will meet it. They have for more than a decade.

Working Closely for Every One's Airframe System

**HYDRO-AIRE**

HYDRAULIC, ELECTRIC, PNEUMATIC, MECHANICAL  
Aircraft Systems of Motion  
Hydro-Aire Division • One  
Barton Road, Inc. • Cincinnati,  
Ohio 45215 • Telex 901000  
Hydro-Aire Corp.

# SARGENT

## SERVO-SYSTEMS OF FORCE CONTROL



With 35 years experience Sargent builds precision linear and rotary hydraulic, pneumatic, mechanical and electronic systems of force control to meet successfully the increasingly high requirements of marine, aircraft, assault, petroleum and industrial use. Please request data to finished products—SARGENT.

### SARGENT FACILITIES

Research  
Design  
Development  
Testing  
Qualifying

### Manufacturing

including—  
Machining & Grinding  
Heat Treating, oil types  
Plating, all types  
Inspection  
Assembly

### SARGENT BUILDS

Servo-Systems  
Hydraulic Systems  
Integrated Packages  
Hydraulic Actuators  
Hydraulic Valves

Hydraulic Pumps  
Hydraulic Motors  
Pneumatic Cylinders  
Pneumatic Valves  
Ball Screw Actuators  
Gear Actuators  
Gear Accessory Boxes  
Electronic Systems

Standard of Excellence



Since 1920

ENGINEERING CORPORATION

MAIN OFFICE & PLANT, 2203 E. 19TH STREET, S.W.

WASHINGTON, D.C. 20018

"GOOD WILL" is the reputation of the product and the service to the place where it has been well treated—D.B. Sargent Corp.

### AVIATION CALENDAR

- Oct. 7-8—Third Symposium on Rheoviscosity, Chicago, Ill. Jointly sponsored by USAMF Office of Scientific Research, U.S. Army, and U.S. Navy, with American Rheology Foundation.
- Oct. 8-10-1965 Annual Aviation Spark Plug and Ignition Conference, Champaign, Ill. at Sheraton Hotel, Urbana.
- Oct. 8-10—Ninth Annual National News Abstracts Symposium, sponsored by American Rheology Foundation, Sheraton Hotel, Chicago, Ill.
- Oct. 12-15—Ninth Annual USAF Weapons Conference, Two technical flights planned. Turned by Command, Natick, U.S. Navy.
- Oct. 13-15—AIAA-ASME Joint Information Conference, Sheraton Hotel, Los Angeles, Calif.
- Oct. 15-15—1965 Annual National Electrical Conference, Hotel Statler, Chicago, Ill.
- Oct. 15-16—American Institute of Electrical Engineers, 1965 Annual Machine Tool Conference, Sheraton Hotel, Hartford, Conn.
- Oct. 16-17—Aviation Development and Operation Conference, New York State Department of Commerce, Hotel Duane, New York, N.Y.
- Oct. 17-18—1965 Annual Meeting Southeastern Airport Managers Assn., The Palm Beach Towers, Palm Beach, Fla.
- Oct. 18-19—British Interplanetary Society's Space Medicine Symposium, R.N.A.I., Hove, London, England.
- Oct. 20-21—Fourth National Aero-Cosmos Symposium, sponsored by Institute of Aeronautics, Hotel Otis, U.S. Navy.
- Oct. 22-25—1965 Annual Meeting, Assn. of The United States Arms, Sheraton Park Hotel, Washington, D.C.
- Oct. 26-28—Ninth Annual USAF Weapons Conference, Sheraton Hotel, Chicago, Ill. (Continued on page 6)

### AVIATION WEEK Including Space Technology

October 5, 1958

Vol. 69, No. 14

Aviation Week and its additional news is a complete guide to the latest developments in the field of aviation. It includes a complete listing of all the major events, conferences, and exhibitions taking place during the week. The week is divided into four main sections: Aircraft, Space, Weapons, and Miscellaneous. Each section contains a detailed listing of the events, including the date, time, and location. The week is a must-read for anyone interested in aviation.

Information and personnel and other data of the week are available in the Aviation Week and its additional news. The week is a must-read for anyone interested in aviation.

Subscription Price and Circulation: \$1.00 per copy. Single copy price, 50¢. The week is a must-read for anyone interested in aviation.

AVIATION WEEK, October 6, 1958

## TRANS-SONICS

PL-1-5

## PLATINUM TEMPERATURE TRANSDUCERS

for measurement, telemetry, and control

- TEMPERATURES FROM -425 TO +1325 F
- PRECISION CALIBRATION
- ACCURACY TO 0.1 F
- ± 5 VOLT OUTPUT
- HIGH RESPONSE SPEEDS



1300 Series



Type 2135



1340 Series



Type 1321



Constant-Ohm Type 1325



World-On Type 1326

**QAIA TYPE for non-corrosive gases and liquids**  
1300 Series transducers are available in ranges from -400 F to +1325 F, 1% accuracy, stainless-steel construction and a time constant of less than 2.5 seconds in neutral liquid. Many standard and special bulb lengths are available.

**QAIA TYPE for non-corrosive gases and liquids**  
1350 Series transducers are available in ranges from -300 F to +600 F, with an accuracy of ±1% full scale. The platinum sensing element comes in direct contact with the gas or liquid being measured, resulting in a typical response time of 0.7 second in neutral liquid.

**QAIA TYPE for all kinds of vehicles**  
Type 1321 is designed for extreme low temperature measurements, with special calibrations to -425 F. Operating range is 30 F in ranges up to +250 F, with ±1% accuracy. A perforated shield protects the platinum sensing element from high flow rates.

**Constant-Ohm Type 1325**  
These platinum temperature transducers can be installed by a variety of methods, on any surface—flat or curved, metallic or non-metallic. The following types are available in ranges from -400 F to +1325 F: Constant-Ohm, World-On, Type-On, Thermopaper, Self-Sensing, and Surface Transducers.

A five-point resistance-temperature calibration, complete to 0.1%, 0.5%, 1%, 5%, and full scale temperature is supplied with each transducer. Custom designs for all temperature transducers are available on special order with accuracies to 0.1 F. Write to Trans-Sonics, Inc., Dept. 50, Burlington, Mass. for Condensed Catalog on Platinum Temperature Transducers.

## TRANS-SONICS

Precision Transducers

# G.E. REDUCES PREMATURE BURNOUTS

to cut down your landing lamp  
replacement costs.

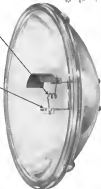
Replacement charges for landing lamps are high. "Grounded" status because of burnouts is even more expensive—and aggravating.

General Electric has done two things to landing lamps to keep both these expenses to a minimum.



**1 RUGGED COILED-COIL FILAMENT**—needs no support wire to prevent sagging, eliminates premature failure caused by "sagging action" of support wire and filament.

**2 METAL STRAPS**—anchor each filament to a lead-in wire, insure constant beam size.



Beam pattern is improved, too, because the compact filament is precisely designed and located to give a sharper beam pattern of more even intensity. Yet G-E lamps cost no more—actually cost less in terms of longer burning hours in service.

Ask your G-E Lamp distributor about landing lamp 6159—or write General Electric Co., Landing Lamp Dept. AW 100, Nela Park, Cleveland 12, Ohio.

Progress is Our Most Important Product

**GENERAL ELECTRIC**

## AVIATION CALENDAR

(Continued from page 5)

- Computers concepts phase, for D. Lee, Command "Triad" AF 8, 130  
Oct. 22-24—1976 National Vietnam Sea  
ports: No. 10000, Hotel, San  
Francisco, Calif.  
Oct. 22-24—Meeting of Vietnam Airlines,  
sponsored by University of California  
Vietnam Hotel, Santa Monica, Calif. 100  
Hotel, Thomas H. Sweeney, 10, D.  
UCLA Medical Center, Los Angeles 24  
Calif.  
Oct. 24-26—Transportation Day, sponsored  
by Chicago Area of Commerce and in  
dustrial, Sheraton Hotel, Chicago 10  
Oct. 25-26—1976 National Seafood Con-  
ference, sponsored by Institute of Sea-  
food, International Group on the  
Inter-Continental, Santa Monica Hotel,  
Beverly Hills, Calif.  
Oct. 27-28—1976 Annual General Meeting of  
the International Air Transport Assn.  
San Diego, Calif.  
Oct. 27-28—2nd Coast Conference on Aero-  
nautical & National Facilities, in  
memory of Robert Johnson, Lord, 100  
Hotel, Baltimore, Md.  
Oct. 27-28—National Aerial Exposition and  
Convention, Cleveland Public Auditorium,  
Cleveland, Ohio  
Oct. 28-31—Air Traffic Control Assn., An-  
nual Business and General Meeting, Ma-  
sonic Hotel, Washington, D. C.  
Oct. 30-31—1976 Florida Device Meeting,  
sponsored by Institute of Aeronautics,  
Hawthorne Hotel, Washington,  
D. C.  
Oct. 30-31—1976 Annual Meeting, An-  
nual Electrical Science, San Francisco  
and Los Angeles, Calif.  
Nov. 6-7—Quarterly Regional Meeting  
Area of Land & Turbomachinery  
Houston, Texas  
Nov. 6-7—1976 Annual Meeting, Institute  
of Aeronautics Professional Group  
on Vietnam Seaports, Nela Hotel, San  
Francisco, Calif.  
Nov. 6-7—National Specialist Meeting on  
Designs and Development, sponsored  
by Institute of the Aeronautical Sciences,  
Texas Section, Texas Hotel, D. Worth  
Nov. 16-17—International Conference, Plan-  
ing and Management of the Aerospace and  
Space, sponsored by the School of Aeronautics,  
University of California, San Diego, Calif.  
Nov. 18-19—1976 Annual International Air  
Transport Science, Flight Safety Foundation  
in cooperation with United Nations  
World Board of Aeronautics, American  
Exposition Center, Atlantic City, N. J.  
Nov. 19-21—1976 Air Transportation Meet-  
ing of the American University, Wash-  
ington, D. C.  
Nov. 22-24—1976 Annual Meeting, Society  
for Experimental Stress Analysis, Hotel  
Marquette, New York, N. Y.  
Nov. 27—1976 Annual Meeting, American  
Aeronautical Association, American So-  
ciety for Quality Control, Baltimore Hotel,  
Baltimore, Md.  
Nov. 27-28—1976 Annual Meeting and in-  
ternational Exposition, American Academy  
of Sciences, Hotel Statler, New York, N. Y.  
Nov. 29-31—1976 Meeting, American De-  
sign and Manufacturing Assn., Statler  
Hotel, Dallas, Texas

**SOLO\***  
LOOKS CAN KILL!



We call it SOLO\*...  
a lethal blend of  
sophisticated electro-optics  
and weapons. SOLO  
enables a missile to "see"  
a solid area objective  
and lock on.

Casualties human life in  
present air-to-air warfare  
mounts (though human  
capabilities are built in...  
all the way to impact...  
minus the human).

\*Selective Optical Lock On  
is a system developed by the  
military and licensed to CAI



**CHICAGO AERIAL INDUSTRIES**

200 RANTHMORE HUNSDON PARK, ILLINOIS • CHICAGO, ILLINOIS 60611

1976 publication systems / 100% & 100% printing services / 100% plus 100% production / 100% plus 100% production

*A special report  
on the  
General Electric  
CJ-805*

# CJ-805 RECEIVES OFFICIAL CAA CERTIFICATION

On Sept. 9, General Electric CJ-805 received its CAA type certification... important milestone in its extensive test program. General Electric's goal in this program: to provide airlines with a reliable, dependable, high-performance jet engine for commercial operation.

Here are highlights of the CJ-805 test program:

## ENDURANCE TESTS PROVE A MAJOR ENGINE

CJ-805 factory tests are proving the reliability of all engine parts, components, and accessories. Progress to date: first endurance engine has now logged almost 1600 hours; second engine runs thru 1225 hours on turbine. A total of 9 engines are now engaged in factory and flight testing.

The endurance engines are run to simulated airline schedules, approximating conditions of successive 1-hour, 1½-hour, and 2-hour commercial flights. Conditions include taxi, take-off, climb, cruise, descent, reverse thrust and taxi operations—a total of over 600 engine hours and stops for every 2000-hour period.

## NO PART CHANGE DURING INITIAL FLIGHT TEST

During initial flight tests, a prototype CJ-805 engine logged a total of 150 hours in 25 working days without a parts change or engine adjustment. Included in the flight tests: throttle bursts and chops at altitudes up to 45,000 feet, plus air starts at various altitudes. Flight tests of the production CJ-805 are now underway.

## 140% OVERSPEED, 73° OVERTEMPERATURE

CJ-805 components are being tested above normal requirements. The core rotor, for example, has been tested to 135% speed; the turbine rotor to 160% speed and 73° over-temperature.

## HAULSTORM TESTS DEMONSTRATE CJ-805'S SUPERB RESILIENCE, DURABILITY

The CJ-805 has been tested under severe hailstorms, sandblasts. One and one-quarter inch iceballs were fired into a running CJ-805 at tested speeds from zero to 637 miles per hour with no effect on engine operation. Power settings included maximum rpm. With two-inch iceballs, the engine took hits up to 378 mph without damage. These tests were

conducted at speeds 30% in excess of requirements.

## CJ-805 REVERSE AND SUPPRESSOR TESTS SUCCESSFUL

A CJ-805 mounted in a Convair 440 test pod is testing G.E.'s Reverse Thrust, TW-22 at General Electric's outdoor test facility. A prototype reverser has already completed 300 strokes.

Acoustical and performance tests of the shrouded delay ejector suppressor are proving successful. The ejector deep provides excellent acoustic efficiency at a wide range of power settings, permitting minimum loss in static performance.

The new shrouded CJ-805, submitted to power American Airlines' Convair

600's, has also been run outdoors for acoustical measurements. Results so far indicate the 41-ton group is highly in excess of engine noise.

## WHAT THESE CJ-805 TESTS MEAN TO AIRLINES

When the CJ-805 enters service, they will join more than 30,000 other G-E turbines built for the Armed Services. These engines have already—

today—logged more than 32,000,000 flight hours and 10 billion flight miles.

General Electric's CJ-509 test program is one more experience that airlines, like the Armed Services, will get ruggedness... reliability... dependability... and economy when they select CJ-805 engines. From the nation's commercial airlines in 1960, General Electric Co., Cincinnati 25, Ohio.

2011

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**



AMERICAN AIRLINES has announced the purchase of 25 Convair 600's, powered by new General Electric CJ-805 turbojet engines. Other models of the CJ-805 will power TWA and Delta Air Lines' Convair 440's.



FIRST PRODUCTION MODEL OF CJ-805 was delivered to Convair last month. Military version of the CJ-805 (the J75) recently powered the Lockheed F-104 to new world altitude and speed records.



CJ-805 SOUND SUPPRESSOR AND THRUST REVERSE TESTS are currently being conducted at General Electric's Peabody, Ohio, test facility.





## DYNAMIC SUSPENSION:

where  
**BEARINGS  
MUST  
NOT  
FAIL!**

Everything hangs on the perfect operation of all critical parts during stationary hoists. No time here for bearing failure!

The requirements of critical moments such as these have guided the design and manufacture of Rollway Bearings for 50 years. At no time have the full resources of design, engineering and production been more heavily devoted to experimental work in aeronautical bearings than right now.

Jet engines, helicopters, radial engines, helicopters, high-thrust control pumps and other devices... where the application and key Rollway personnel are ready to tackle the specific bearing problems involved.

Their experience\* in high-stress, high-temperature, high-precision bearings is at your immediate disposal on receipt of a wire, letter or post of Rollway Bearing Company, Inc., Syracuse 4, N. Y.

\*Full testing capabilities in laboratory and test cells are at your disposal. Also, we have the latest in bearing design and repair services available.



# ROLLWAY BEARINGS

Rollway Bearing Company, Inc. Syracuse 4, N. Y.

# FIRST in Missile Plumbing!

Aeroquip offers the experience... complete product lines... start-to-finish engineering service required to solve the full range of plumbing problems



Global Action Fuel Manifolds were developed by Aeroquip for the General Electric X-400 engine that powers the first stage of the Vanguard missile. Combustion of Aeroquip 601 lightweight engine hose and precision formed tubing solved the problem.



Hydraulic Lines for Portable Launcher used to send Nike-Cajon sounding rocket up from the Arctic Circle were made from Aeroquip hose with Removable Fittings. Aeroquip manufactures a full range of standard hose types for any fluid line application up to 10,000 psi.



North Atoll Transfer to Missiles was made safe with the development of Aeroquip 610 KSL-F hose lines with stainless steel fittings. Future photos show KSL-F hose being used for testing the Navy Vanguard.

Let Aeroquip help solve your plumbing problems. Write for information.

## Aeroquip

AEROQUIP CORPORATION, JACKSON, MICHIGAN

AEROQUIP CORPORATION, WESTERN DIVISION, BUNHAME, CALIFORNIA AEROQUIP (CANADA) LTD., TORONTO 16, ONTARIO



AEROQUIP CORPORATION, JACKSON, MICHIGAN—PLEASE SEND LITERATURE AS INDICATED				NAME																																																																																																																																																																																																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																				
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15																																																																																																																																																																											

# 8 Year Study Proves Each "POP" RIVET Saves 4.9¢ on Installed Costs



**How They Work**

Before and after setting in typical blind assembly.



**High Clamping Action**

Exerts as high as 450 pounds pressure between parts.



**Wide Girth Range**

Exerts length "POP" Rivet holds tight through 400s or 500s.



**Vibration Proof**  
"POP" Rivets resist both air and seismic loads.



**Size Doesn't Prohibit Design Flex for Selection and Use Here**



**Proven to Metal Easy**  
"POP" Rivets do not fracture the plastic because it is held in compression.

## Saves 4.9¢ each over other blind rivets Saves 1.8¢ each over solid rivets

Hardware 100,000 solid rivets with strong, high strength "POP" Rivets and you save \$1.8¢. Use case-tested "POP" Rivets in 100,000 blind applications and you save \$4.9¢.

No other rivet even approaches the installed cost savings of "POP" Rivets in many uses. The Macall Company saved \$72,000 on one 50¢ plate construction alone—and on today's rapidly increasing costs, savings through the use of "POP" Rivets are even greater.

Whether you design or make machine, glass, or frames, rigging, electrical, power handling or support equipment, rivets are the savings "POP" Rivets offer you. There are steel for all non-structural assemblies and have been approved for various specific structural and plastic uses. "POP" Rivets have been used for several years on both military and commercial aircraft. Our application engineers will break complete test data.

Estimate your own rivet cost savings—how, what, and where, now, or please in today. You can cut your fastening costs immediately without need for extensive re-tooling.

## Estimate your net savings by changing to "POP" Rivets

Quantity	Steel Rivet	POP Rivet
100,000	4.11¢	3.74¢
100,000	4.60¢	3.25¢
100,000	5.10¢	2.75¢
1,000,000	12.00¢	48.00¢

Please check design to prevent for a hot application.

THIS SPACE  
RESERVED FOR ANOTHER\*  
SEALOL-EQUIPPED  
SATELLITE ROCKET



## TYPICAL INSTALLATIONS

**EXPLODER**  
COX Pump Seal

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"

1000-4000 RPM  
TMP Seal - 100" x 100" x 100"



With the successful landings of the "Explorer" and "Vanguard" satellites, Sealol Machine Seal has established a proven place in the conquest of space. For Sealol engineers designed and developed the seals used in both first stage rocket engines.

Our vast engineering agency and research center is at your service—whether you're designing satellites... or pump pumps. Specify Sealol machine seal... for every application.

**SEALOL**

SEALOL CORP. • Providence 5, R. I.

New York • Philadelphia • Cleveland • Detroit • Los Angeles  
Houston • Chicago • San Francisco • Dayton • Toronto

United Shoe Machinery Corporation  
West Medway, Massachusetts • Telephone 3-1111









# SWITCHING PROBLEMS?...

in aircraft, missile, electronic, or industrial applications

## ELECTROSAP ENGINEERING CAN HELP YOU

Qualified engineering can save you time, money and effort on any switch application — with "standard" switches satisfying special performance demands.

Thousands of switch configurations available for "off-the-shelf" delivery.

### SUB-MINIATURE BASIC SWITCHES



Actual size:  $1/16" \times 1/16" \times 1/16"$   
Single Pole, Double Throw  
10 amps: 125/250 V. A.C.  
Temp. range:  $-157^{\circ}$  to  $+250^{\circ}$  F.  
Conforms to Military Specifications  
Operating Characteristics can be tailored to meet any requirements.

### STANDARD BASIC SWITCHES



Actual size:  $1/2" \times 1/2" \times 1/2"$   
Single Pole, Double Throw  
10 amps: 125/250 V. A.C.  
Conforms to Military Specifications  
For more detailed switch characteristics see our standard switch application book.

### RULE-POLE SWITCHES



Actual size:  $1/2" \times 1/2" \times 1/2"$   
Double Pole, Double Throw  
10 amps: 125/250 V. A.C.  
Conforms to Military Specifications  
For more detailed switch characteristics see our standard switch application book.

### MINIATURE BASIC SWITCHES



Actual size:  $1/8" \times 1/8" \times 1/8"$   
Single Pole, Double Throw  
10 amps: 125/250 V. A.C., 50 amp: 250 V. D.C.  
Temp. range:  $-157^{\circ}$  to  $+250^{\circ}$  F.  
Conforms to Military Specifications

### ACTUATORS



Thousands of "standard" types available for your application.

### ENVIRONMENT FREE

Push-button, relay mounted  
Single Pole, Double Throw  
10 amps: 125/250 V. A.C.  
Temp. range:  $-157^{\circ}$  to  $+250^{\circ}$  F.  
Conforms to Military Specifications  
For more detailed switch characteristics see our standard switch application book.



### HERMETICALLY SEALED SLIT SWITCHES



Double and triple contact  
Actual size:  $1/8" \times 1/8" \times 1/8"$   
Single Pole, Double Throw  
10 amps: 125/250 V. A.C.  
Temp. range:  $-157^{\circ}$  to  $+250^{\circ}$  F.  
Conforms to Military Specifications

### LIGHTED PANEL SWITCHES



Double Pole, Double Throw  
Actual size:  $1/2" \times 1/2" \times 1/2"$   
Single Pole, Double Throw  
10 amps: 125/250 V. A.C.  
Temp. range:  $-157^{\circ}$  to  $+250^{\circ}$  F.  
Conforms to Military Specifications

### DIE CAST INJECTED SWITCHES



Single Pole, Double Throw  
Actual size:  $1/2" \times 1/2" \times 1/2"$   
Single Pole, Double Throw  
10 amps: 125/250 V. A.C.  
Temp. range:  $-157^{\circ}$  to  $+250^{\circ}$  F.  
Conforms to Military Specifications

### NEED A SPECIAL SWITCH?

Often standard switches can be modified to do the job. If a special switch is required, ElectroSnap Engineering can create new switches on any quantity to your specifications. Send us your problem and we'll answer you soon.



## ELECTROSAP CORPORATION

4125 Lake Street, Chicago 24, Illinois  
Telephone: VAN Buren 4-2100  
TWX: NA-1435

# EDITORIAL

## The Year Since Sputnik

It has been put a year since the beep-beep of the Soviet star Sputnik marked the dawn of the space age and radically altered this country's perspective on its scientific achievements and technical development. It is a good time to look back over the year since Sputnik I appeared in the sky to evaluate just what progress we have made in matching the Soviet's pace in the two key areas of ballistic missile development and space exploration. The democratic processes of government do respond to public opinion, but this grand relatively slowly toward major policy shifts and administrative restructuring.

We have made considerable progress during the year, both at the top governmental level and in scientific exploration and development. But whether this progress has been a step toward or away from the pace of the Soviets is doubtful. Certainly it is evident that that one year since Sputnik has not been sufficient to close the margin of Soviet achievement and regain the position lost we once enjoyed in technical development.

The year since Sputnik has been a period of frantic government, scientific and industrial circles, reacting to the problems posed by Soviet technical achievements and the missile technology on which they are based. We do not think the American people or the Congress have been completely or sufficiently in the grips of the Soviet challenge compelling to tackle the tremendously expensive job of making up for lost time and regaining our superiority across the board.

The complacency, indifference and unwillingness to get on with the job have come from the highest levels of the executive branch of the government and there they remain today as the major obstacles to handle before the U. S. can fully realize the fruits of its scientific and technical capabilities.

There have been some concrete achievements. President Eisenhower at long last has finally for a missile adviser with direct access to the highest White House circles, and Dr. James Killian, president of Massachusetts Institute of Technology—moving in the past behind a cloak of administrative secrecy—has been playing an active role in shaping Administration policy, both on military and civil research and development. Defense Department reorganization, aimed at speeding research and development in missile space in missile policy by creating, first, the Advanced Research Projects Agency and then a director of research and engineering. But it has found no candidate willing to tackle the latter job and it still left AUSA surrounded by the administrative and type of earlier organizations which are still functioning.

The National Aeronautics and Space Administration has been created from the nucleus of research facilities and personnel of the National Advisory Committee for Aeronautics. But a rather crude job of legislative engineering has left some of the valuable assets and working staff that made NACA such a successful research and development organization.

Most holders were done on the advance, executive which in the past has been staffed by top level technical people representing all segments of the associated field including military and civil interests. This committee functioned actively, took its work seriously and

made significant contributions to the direction of our associated research and development programs which enjoyed singular success and world leadership in the post-war decade of supersonic aircraft.

The National Aeronautics and Space Council, which succeeded it as a group devoted to steering from the start by its very composition. The President, Secretary of Defense, Secretary of State and Chairman of the Atomic Energy Commission cannot be expected to devote the energy and attention to this activity that their membership on the council really requires. The first council meeting last month indicated this clearly with several deputies sitting in for their chiefs. Nor have the public appointments to the council been inspiring with the exception of Dr. James H. Doolittle. The appointment of Dr. Alan W. Watson, Defense Research and Development Administration, to the council on the same note of the first, inefficient signs that have been so familiar in the research and development success of the past.

Nowhere is there evidence of any fresh new thinking so badly required to inject vigor and intelligent direction into this vital area. As to the space agency itself, most of the year since Sputnik has been devoted to debate over its organization, scope of mission and financing, and little in the way of positive achievement can be expected for far into next year even under the most vigorous leadership and adequate financing.

A year after Sputnik, the most advanced ballistic missile we have in the hands of fighting troops in the Army's 200mm range Redstone. The Soviets have had several types of ballistic missiles with longer ranges than Redstone in operation, not with troops for several years.

In the intermediate range ballistic missile area, we are still in the development test stage, as both the Army's Jupiter and the Air Force Thor. Top British officials recently indicated the basic data for getting an American ICBM operational in Europe has slipped close to a year from this year's estimates.

In contrast, the Soviets have been test firing missiles in the ICBM class for more than a year on a schedule and rate that clearly indicates operational troop testing with a weapon of high reliability. In the ICBM field, we have test fired 11 Atlas missiles with varying success but have not yet fired one on a full range mission. The Soviets fired their first ICBM successfully over a 10,000 n. mile range in August, 1957, and have made at least one successful full range test of their ICBM during 1958 as our entire program of Atlas test firing. This weapon will become operational in some degree during 1960. It would be foolish to draw any conclusions from the Soviet firing programs, which is well observed by USAF technical equipment.

In the satellite programs, we have not been able to put anything into orbit that seriously approaches the 3,600 lb. payload of Sputnik III although the Army's Explorer III made a significant recovery of an entire cosmic radiation area and Explorer IV provided valuable new scientific data of this nature. On more than, we have failed once and the Soviets at least five times to either hit or orbit the moon.

We still have a long way to go to require our significant superiority in new weapons development and scientific leadership.

—Robert Holt

auxiliary power subsystems

#### NEPHROLOGIC POWER UNIT

ELECTRONIC TRUCK BODYLINE UNIT

Cooling units have 50 to 50,000 watts design/ton ratio and ratings for two cooling units are furnished from 100 to 4,000 watts. Combs, the leader in the field for controls and cooling engineering for

EASTERN INVESTIGATION UNIT

Video electronic systems that depend on a supply of steadily available video processed are also mastered by these units. A continuing program of research and development on commercial, laboratory, and a control systems ensures that you have the most advanced and the very latest advances in this field for temperature, high temperature, resistance, and conductivity. They are custom made to your specific needs and meet tight military specifications.

**TESTED** reliability in auxiliary power



Further progress will come  
within reach, he thinks.

Wormholes connect different parts of space and time, and are a key feature of general relativity. They are often used in science fiction to describe a shortcut through space. In reality, they are a theoretical concept that has not been observed.

schizophrenia  
delusional  
paranoid  
schizophrenia

### In the Front Office

1. **Ward Kramer** succeeds John Lane Collier as chief executive officer of The E. I. du Pont de Nemours & Co., New York, N. Y. Mr. Kramer is president, and Mr. Collier now serves as board chairman.

Edward F. Nichols, board chairman, and A. V. Anderson, president and general manager, The Laminated Sheet Co. (Glasbead, Conn.). Also: Merle L. Rockwood, executive vice president and director of sales; Richard Sepp, vice president-engineering, research and development; Otto Skold, vice president production.

H. G. Nade, president of En-Coff-O Corp., a division, Dextrin Chemical Industries Inc., Detroit, Mich.

William H. Brown, board chairman, Alusal Corp., El Segundo, Calif. A. L. Schoeffeleus, secretary. Vg. Brown is president and general manager.

John A. Elliott, a director, Beech Aircraft Corp., Wichita, Kan.  
 Pat Leone, a director, The Cabnet Co., Cleveland, Ohio

Carl F. Schlegel, vice-chairman of the board The Schlegel Manufacturing Co. Rochester, N. Y. Kenneth C. Schlegel succeeds Mr. Carl Schlegel as president and chief executive.

### Honors and Elections

Donald W. Douglas, founder and chief executive officer of Douglas Aircraft Co., has been named recipient of the Franklin Viadot. The Franklin Institute's highest award, for "the creative engineering in the field of aeronautical design," honors him for his role in the DC series of transport airplanes.

**John Young, Jr.**, North American agent and worldwide sales manager for Salsco, has been elected chairman of the 1979 INTA Agency Committee, Western Hemisphere.

**Below:** Longlider, system engineering director at Boeing's Systems Management Office, has been appointed a board consultant to the Advanced Research Projects Agency Washington D.C. Mr Longlider, on a one-on-one basis from Boeing, will be chairman of a committee in the field of space systems and technology.

## Changes

W. E. Hughes, head of engineering and Ray W. Swider, senior member technical staff, Space Electronics Corp., Cleveland, Ohio.

J. W. Anderson, assistant general manager and Richard F. Whitcomb, assistant to the general manager, Eastman Water Division, Thetford Chemical Corp., Danville, N. J.

George A. Hume, director Purchasing Division, American Airlines, Inc.  
Roy C. Hosook, manager, Standard Steel Corp.'s newly established Cryogenic

Robert D. Backe, design engineer, William Clemens, Research Design, Lock

(Continued on p. 105)

## INDUSTRY OBSERVER

- Recent top-level Defense Department decision gives the Air Force clear cut responsibility for the development of strategic reconnaissance satellites and sharply curtails Army's satellite missions to those concerning weather reconnaissance. Army contract with Radio Corp. of America's Atrix Electronic Products Department to develop strategic reconnaissance satellite instrumentation has been cut back and is being redirected solely toward weather reconnaissance. Instrumentation for USAP Lockheed Scaler Scout reconnaissance satellite is being developed by Aerospace Instruments Laboratory, CRL Laboratories, Easting Kodak and Philco.

► Soviets have a large nuclear-turbine engine and a large land-based aircraft in which it could be tested, leading some U.S. observers to believe a nuclear-powered aircraft race still be flown before the end of the year.

\* Defense Department is considering joining the efforts of General Electric and Pratt & Whitney in the development of nuclear engines in an aviation program. Combined funding by Air Force and the Atomic Energy Commission on development of the GE nuclear engine, the X311, was to approximately \$100 million each year. After the Sonnet launching at the Spinet, 1 inch axle, development of nuclear powerplants was put on a crash basis only to be again de-emphasized.

\*Contracts to be awarded soon in the development program of North American Aviation's WS-110A weapon system will be for an auxiliary power system and for ground power units for the B-70 thermal boiler.

★ West German plans will visit the U.S. later this month for a final discussion of configurations and proposed proposals by Lockheed for its F-104 and Grumman for the F-111F. German decision on the selection of one of these aircraft probably won't be made until December. The Swiss choice of a U.S. fighter probably will be the same as the German selection.

Lockheed's Marietta, Ga., division is seriously considering the production of its 500-mph. jetstar CL-129 utility jet transport whether the Air Force places an order or not. Company now has more than 70 potential commercial customers for the \$1 million jet.

\* Critical valves developed by Minneapolis-Honeywell Regulator Co. for handling very high pressure liquid oxygen and gases at bohring waste launch sites will be tested at Edwards AFB, Calif., later this year.

\* Architect-engineering services for a tracking and telemetry station at Cooke AFB, Calif., to be used in conjunction with the Lockheed Scout reconnaissance satellite system are being awarded by Ralph M. Parsons Co., of Los Angeles.

► Republic Aviation Corp. has selected Pratt & Whitney's JT12 small turbojet engine (AW Sept. 29, p. 31) for an advanced drone now under development for Army.

\*Studies on desensitization of course, probably aimed at promoting use of the material as an additive for rocket motors, are being conducted for the Air Force by Ohio Matheson Chemical Corp., American Research Foundation, Air Reduction Co. and Union Carbide and Carbon Co.

► Historic British competition now going in for a Caribean replacement. Requirement, designated OB170, calls for a low-level bomber with significant dash capability. Competing firms include Vickers, Short Bros and English Electric. Some pressure is being brought to bear to have the Republic F105 adapted to the requirement and built under licence in Britain.

► Air Force intends to send teams to England to evaluate the Blackburn NA.39 attack fighter and the Fairey Rotundone.

## Nuclear Aircraft Push

Advocates of an accelerated nuclear aircraft program are making another effort to gain approval of a major new funds. Titled since last spring by the President, they are more convinced than ever that the USSR will be a nuclear aircraft within months, leading a major propaganda campaign around the world (see p. 25).

Regardless of the fact that the U.S. cannot fly, they support the program because, they claim, development is essential to advance knowledge of modern propulsion, learn their limitations and produce a viable atomic aircraft.

Although last spring's attempt to get the up-and-down program up again resulted in the White House kind, some changes in President Eisenhower's scientific adviser, headed by Dr. James B. Conant Jr., seemed to reawaken interest against new aviation before they could head the advance of progress and research for a faster program.

## Airport Aid Assurances

Administration thinking on airport aid seems to have undergone a switch to the "if you can't lick 'em, join 'em" philosophy. Edward F. Quinlan, new Federal Aviation Agency head (see p. 31), said with Sen. William McGowan (D-Okla.) last week on measures a preliminary of the Airport Operation's Council at Tulsa of the new funds for airport expansion that would be available next year.

Quinlan pointed that a new Administration sponsored Federal Airport Aid bill will be introduced at the next session of Congress. Sen. McGowan said he would reintroduce on the opening day of Congress the same \$100 million airport aid bill vetoed recently by President Eisenhower. Pending passage of the bill by Feb. 1 McGowan added that it will contain no extra \$75 million to help interstate work, an act regarded by airport officials as a possible aspect of performance of a presidential veto will be nullified by a congressional override of the White House action.

## Court Challenge

Legality of Federal Communications Commission's April 16 action in withdrawing 1,800 mc. band from civil Doppler radar use is being tested by suit filed in U.S. Court of Appeals, District of Columbia Circuit, by Aero-Space Radar Inc., Air Transport Association, several airlines including United, TWA and Pan American, and Radio America, an air transport manufacturer. Action now taken to establish FCC's basic authority, despite subsequent commission action which opened the 1.8 to 1.9 megacycle use of 1,800 mc. band in civil use.

## IATA Traffic Control

International airlines are now reconsidering to their governments the adoption of air traffic control procedures that would bring positive control of all high altitude air traffic on international routes within five years. The proposed action, already approved by airline members of the International Air Transport Association, at a recent high level conference, calls for boundaries of flight between two regions to be based upon major structure configuration and not on national boundaries.

Greater freedom of operation will be allowed once of airport opening below, aircraft needed for common transport aircraft under the proposal. In addition, the airlines have asked for closer coordination with military units in the use of radar facilities and will attempt to plan controlled airspace so that a wider choice of routings and separation criteria will be possible.

## Lease Battle

In a surprise move, Eastern Airlines has opened a second front in its battle against the controversial National Airline Airlines order, exchange and equipment lease program. Eastern made the first move to block further competition on the New York-Florida route by asking a full-scale Civil Aeronautics Board investigation of the plan.

Last week the carrier attacked from a new direction by petitioning the Federal Communications Commission to revoke the license of television station WFTS-TV (Channel 38), Miami. Now controlled by National Airlines, the station could parallel its use in a general advertising campaign by Pan American if the past proposal before that carrier is not blocked, Eastern attorneys said.

## CAB Concern

Air Force holding procedures have the Civil Aeronautics Board concerned that provide below, but customers may be even more concerned with an economic operation which might endanger their safety, according to Association complaints concerning competing carriers in the recent wording of Military Air Transport Service contracts. The CAB said it has no effective control over both sides for airlines, but has been advised by the Department of Defense that any move to depart from the guarantee of competition and safety would "lead to chaos" in the procurement of civil aircraft. Nothing that one of the last submitted appeared adequate, the Board said it is determined to find a solution to the current uncontracted holding provisions.

## Third Pilot Dispute

Eastern Air Lines last week found itself trapped in the middle of professional dispute between Air Line Pilot Union and the Flight Engineers' International Union. No matter which way the carrier moves, it faces the threat of a strike from either union despite the delays provisions of a Professional Engineers' Board recommendation that should guide the three parties to an amicable solution.

However, the engineers have rejected the Board's recommendation and it is evident that the third union crew members and the union has renewed working that it will strike if Eastern unaccepts the Board's findings into the pilot contract. Flum, on the other hand, are now threatening a strike scheduled to come off at midnight last Saturday—unless they are given a contract that satisfies the Board's findings. Strongly resented, the pilot union which has praised the Board's ruling, will in effect, reject that ruling by striking Eastern.

—Washington Staff



## MISSILE GUIDANCE SYSTEMS

## Projects of H. T. Budenbom,

Senior Scientist, Stavid Engineering, Inc.

Included in Mr. Budenbom's 20 patents and numerous technical papers are his original contributions in cooperative development and engineering of many new concepts in the application of electronics to modern warfare. His experience and knowledge in the application of electronics to weapons systems development and missile electronics. Mr. Budenbom is now of a group of outstanding scientists and engineers at Stavid who are working on advanced concepts in the development of missile systems development.

In Stavid's advanced engineering atmosphere, scientific development and manufacturing systems are producing a wide range of electronic systems for all branches of the military. A typical project calls for development of the high power Radar Set AN/SPW-15.

## OTHER STAVID PROJECTS INCLUDE:

- Anti Missile Systems
- Airborne Search, Tracking and Target Classification Radar
- Missile Tracking Receiver
- LANCE Weapon System
- Radar Infrared Airborne Fire Control System
- Automatic Missile Guidance System

**STAVID Engineering, Inc.** - Fairfield, New Jersey

*Imaginative Electronics...*

# Industry Faces Increasing Competition

**Defense begins push to decrease use of government facilities; encourage privately-financed plants.**

## By Evert Clark

Washington—Industry is being forced into a more and more competitive position by changing Defense Department procurement policies that reflect the constant pressure of technology, economy and the apparent advantages of select companies that have not varied the relatively outmoded production of older weapons lines.

One of the strongest manifestations of these changes is the current drive to decrease the use of government-owned facilities and production equipment and encourage use of privately-financed plants and tools.

Recent philosophy behind the drive was laid down last spring as two Defense department directives (4007.13 and 4007.14) both reflect the viewpoint that the broad mobilization has had no volume production of World War II is no longer necessary and are aimed at cutting the government-financed industrial base to the minimum that still will allow for both growth and limited war.

Executive 4007.14 says that reliance on maintaining the industrial base will be in the order of priority:

- Privately-owned facilities and production equipment.
- Privately-owned facilities and associated government-owned production equipment not available in the civilian economy.
- Government-owned facilities and production equipment.

Executive 4007.13 states that the role of the industrial base is to provide the means of producing lowest quantities in privately-owned capacity, where such action is in the best interest of national security.

While these and later directives provide a number of warnings, the intent clearly is to decrease the large government holdings, force industry to improve its own plants and tools and give a better competitive climate so companies whose facilities are profitably financed. Some of the pressure for such a move has been furnished at Defense Department through Capitol Hill.

An issue has resurfaced in the discussion with an increasingly larger interest in trade on costs. Among the reasons are:

- USIAF has a \$1 billion (conservative) inventory of facilities and equipment. While it is still used help supply hardware, many items are in deep redud. It is determined not to supply government equipment that causes an already overburdened man-

facture. It has further to go than the other nations in adjusting its resources to meet national policy. It also is open to more criticism than others that its older supplies have an undue advantage over prospective contractors who have only private facilities.

- Weapons facilities are increasing in capacity, in performance, size, complexity and cost that plants and tools become obsolescent more rapidly and are replaced accordingly.

- As weapons advance away from the old pattern of sub-production to the new pattern of hand-finished models, cost plans has shifted from the production and of the scale toward development, and facilities have been given increased responsibility for management of the development. While USIAF intends to reveal this increased responsibility with incentive and penalties, contracts, it also intends to maintain control of costs and limit on non-private investment.

Li Gu Clarence S. Irvine, USIAF deputy chief of staff for technical, recently stated the attitude that military development and production is a sort of emergency type program, with no selling management and extensive government and pointed the investment of industry capital. Speaking at the defense forum of Pratt & Whitney Aircraft, Florida Research and Development Center, he said:

Research, development and production of military hardware will be a primary part of industrial activity, and much like in the industrial base is a fact as well as an ideal. Civilian and military "The pattern of industry, then, must recognize defense requirements as being integral to the industrial scene and treat them accordingly."

Management at all levels must cut running overhead, reduce item costs and "take steps to ensure that these production capabilities are effectively upgraded by modern testing and techniques," Irvine said.

"Significant in accomplishing these goals is initiative of private enterprise. Some companies tend to resist until they are forced into participation of the government in finance was given only considerable progress that appears necessary."

"On this score, I think Pratt & Whitney is to be commended for the way it has taken. In its coming more than 550 authors of its own capital, it has demonstrated a rational degree of thoughtful courage and con-

science in its own future potential. This is especially significant where a security and development center is concerned."

A few weeks earlier, he had posed Whelan for using private capital to build and equip the \$4,000 sq. ft. Amherst Research Laboratory at Westhampton, N. Y., noting it indicated the concern of Whelan with "the company's responsibilities in meeting the defense challenge."

In fact, the one of the most telling factors involved here is "Irvine said "When industrial leaders take the initiative and finance their own facilities construction, without relying on government subsidy, the demonstrated leadership is not excessive, and suppress confidence in their employees."

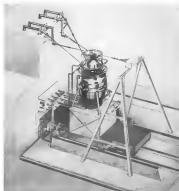
Latest management had devoted to "An effort to ensure that maximum support covers those subcontracted and from privately-financed production capacity is the "make or buy" policy now in the final stages of formulation. USIAF will it consolidates long-standing principles and policies but it does include some controls. Industry objectives already have applied in some modifications and further industry commitment is due Oct. 24, but USIAF says there is agreement in principle.

"Make-or-buy" will operate this way:

- Bidding on contracts over \$550,000 that will require sub-contracting or extensive provisions or involve use of government facilities will require "make-or-buy" structure in most of their proposals. This is a list of major or critical components, assemblies or sub-assemblies, ranging from 10 to 50 items and including whether a contractor is making government use of sub-contracting, privately owned, whether they will be done in private capital or government-owned facilities.

- USIAF will evaluate the "make-or-buy" structure as part of the proposal, and evaluate claims of accuracy.
- Structure agreed upon will be incorporated in the contract and the contractor must submit the administrative contracting officer in advance of proposed changes. If Air Force decision with a contractor's decision to increase his in plant work, it can in various cases withhold the use of any government-owned facilities involved.

As a part of the implementation of the Defense directives, Air Force also has laid down the guideline that new facilities expenditures will be authorized only on an absolute minimum basis and any area beyond research and development and pilot production. Defense industrial facilities support established where a contract is negotiated also is subject to review.



**Nuclear Rocket Propulsion Reactor**

During development, Air Force nuclear rocket propulsion reactor as it will appear when state of the art is reached. The reactor is a part of the Air Force's Project Rover program (AW 4007.13) in the end of the year. Reactor fuel is based on the program, as designed by Air Force Research Laboratory. Reactor shell and supporting equipment were designed and built by Nuclear Products Inc. Division of NRP Industries.

## More Missile Contracts Asked For Small Business by Senate Unit

By Ford Eason

Washington—Greater participation by small business firms in the Defense Department's missile procurement program was urged by the Senate's Select Committee on Small Business in a strongly worded report issued last week.

The committee led by Sen. George A. Brown (D. Cal.) contended that small contractors can make valuable contributions to the nation's missile program and should be called upon for maximum participation at all levels of procurement of advanced weapons systems.

The small business is in the upper echelons, the committee declared. The report said that of the \$5 billion to be spent this year for Defense Department missile procurement, small business firms received less than 1% of the prime contract dollar. On

the other hand it added, perhaps of missiles, and related items has climbed in the last year from less than 1.5% to about 24.5% of the funds spent for weapons.

The committee also warned that repeated violations in recent years of contract awards to small defense manufacturers and producers with no noticeable contracting success in subsequent awards, may bring an end to the small firm serving as a direct supplier to the Defense Department within the next decade.

### Other Findings

Other findings made in the committee report, which followed an inquiry into the role of small business in defense missile procurement, had earlier this year included:

- Director of Guided Missiles for the Defense Department William Holder

deploded a disappointing lack of appreciation for both the contribution made to the defense effort by smaller firms in the past and the substantial role that Congress determined they shall play in all missile programs now and in the future.

- "Weapons systems concept of procurement has been a detriment to small business participation at the prime contract level in the missile field."

- "Contract award decisions to increase the dollar value of existing contracts also source having procurement size restrictions and the lack of adequate specifications and drawings are serious reasons for the low small-business percentage of missile awards."

- "There is a growing tendency on the part of some missile prime contractors to consolidate their subcontract requirements, subsequently placing sole contracts for these combined items with other large or medium-size contractors to the detriment of small business."

- "Schedules for missile support equipment ordered to a limited extent by the Navy's Bureau of Ordnance are most unreasonable and indicative of the excellent and increasing small business programs being carried out within that agency."

- "Committee was especially distressed by the Secretary's Assistant Secretary of Defense, Supply and Logistics Paul L. McGowan's agreement to sponsor a program designed to break up into smaller units smaller contractors (smaller firms for production contracts) after strategic effectiveness have been established and to further explore the Navy's technique for contracting with several prime contractors for each missile."

The committee said it is apparent that there are no serious efforts underway in the Pentagon to boost the low small-business percentage of defense funds.

The report added, however, that objective, continued and proper consideration is the subject of informed reports document that small business be permitted to play a significant role in the defense effort. The committee said the

### Merge Talks Fail

Los Angeles—Mergers negotiations between Northrop Aircraft Inc. and Aerojet Corp. Bank America Corp. collapsed last week. As Aviation Week reported (AW 4007.13) the two companies had been in the midst of negotiating a merger to combine the two companies into a single stock exchange unit.

Walter C. Coffin, Northrop president, and others were several points in which the negotiation could not agree. Among them are have been the management lineup of the combined company.

profitability and capabilities of the independent producers should also be preserved and utilized to the fullest extent possible in order to maintain the fast and competitive economic system.

The group and the members of the profilers have been acknowledged and their beginning has been made within the Defense Department.

But, it added, new and vigorous programs are required if such business firms are to achieve maximum participation in the procurement of advanced military weapons.

The group said that the Office of the Assistant Defense Secretary, Joseph W. Lippert, is expected to initiate the various studies and surveys required to determine just how small business

can be given a larger slice of the defense dollar.

Establishment of the Small Business Administration as a government agency, together with an energetic effort on the part of the Assistant Secretary's Director for Small Business Policy, should result in greater strengthening of the program the report said.

Another factor that would contribute to strengthening the overall small business program, the report concluded, would be the designation of an individual within the newly created Technical Department Office of Director for Research and Engineering, whose duties would be to study the various studies and surveys required to determine just how small business

can be given a larger slice of the defense dollar, and calls for it to be under the probable scope of Soviet missile threat," he declared.

Douglas said the Russians are interested in having a very small-scale system of launching one or two satellites in an operational mode during the next year and a substantial number earlier in 1963. He considered that the Russians have a considerable number of missiles with range under 1,000 miles and he noted that they are not developing sub-sonic launchable ballistic missiles at the thought tactical element is lacking.

In contrast, Douglas noted that the U. S. has successfully launched four satellites and that their small size gives little indication of the propulsion system available for the large ballistic missiles. He pointed out that Thor and Jupiter tests have proven all their components and that both are in production for operational needs.

Douglas said that the success of Atlas test flights started in July last "ultimately forced the complete propulsion system, including the boosters, engines and separation of the nose booster engines, payload guidance, and nose separation and re-entry. Although we have not yet in a successful flight, these tests represent a major step in confidence that the first Atlas squadron will be equipped with operational missiles within the next year," he concluded.

#### Titon Tests

Titon is scheduled for its first test soon, Douglas said, and Minuteman will be an important addition to the arsenal. He said the equipment for its production for assembly and testing at Minuteman is under way and that component testing will start in the "next few months."

Noting the development of the Delta missile, he said, "the Navy, Douglas said it will be a useful addition to U. S. defense weapons arsenal and "will bring new and effective products of defense in an extremely short time. It has the advantage that it can be assembled only by the airplane with a ballistic missile ground out."

Douglas feels that the progress of U. S. missile programs indicates that the country is in a position of relative defense capability, without any gap between the present bearing force and the future force of missiles and missiles.

So far, he said, the new super-sonic delta wing bomber with its tandem engine was approved by ARTHUR W. H. (p. 23). Reports at that time indicated that the aircraft was fast performance capabilities similar to those of USAF's B-58, an aircraft developed by North American Aviation.

"We are far ahead of the Soviets in

long-range manned bombers and we are not far behind," Douglas said. "I have Soviet statements that a new long-range bomber has been flown. This development, of course, emphasizes the importance of our own advanced bomber programs and of our long-range interceptors and air defense missile programs."

Discussing air defense capabilities, the USAF secretary told the AFA that the direction orders of the SACV system are in operation and that Russian interceptors of over 100 mi have been limited by SACV. He pointed out that the SACV system is in operation and that Russian interceptors of over 100 mi have been limited by SACV. He pointed out that the SACV system is in operation and that Russian interceptors of over 100 mi have been limited by SACV.

"This conclusion points up the importance of our long-range bomber, missile programs and the need for the super-sonic F-106 interceptor with a mission of 1,000 mi," Douglas concluded.

The main danger military (that facing the U. S. Soviet arsenal, Gen. Thomas D. White, USAF chief of staff, told in AFA group, adding that the advent of ballistic missiles has not changed this threat, but has merely changed its character. He said that the main danger military (that facing the U. S. Soviet arsenal, Gen. Thomas D. White, USAF chief of staff, told in AFA group, adding that the advent of ballistic missiles has not changed this threat, but has merely changed its character.

Observing that "some people are easily misled" about U. S. shortcomings in the missile field, Gen. White said "we have an excellent long range missile" in the Thor and Jupiter test program. He said the long-range intercontinental ballistic missile test program has achieved an overall excellent test performance and he stressed that it is very hard to compare with the Soviet "Able-Able" missile. He said that the ICBM now cost about a predicted target cost \$100 million.

This, he said, is a grossly exaggerated figure but has been found to be an order of magnitude in an order of magnitude.

Gen. White said the ballistic missile effort of the X-15 and the D-1550 project form a good line for future aircraft program. He said the D-1550 project is to build a future line, with a close relationship between aircraft and command systems.

In a pre-conference speech to the American Airlines, Douglas C. Clark, assistant secretary of defense, said that the USAF is putting more intensive efforts into aircraft and is also studying ways to establish command systems. He said the USAF is putting more intensive efforts into aircraft and is also studying ways to establish command systems.

"We are far ahead of the Soviets in

'The results of this type of research would be available far more later review by the Air Force by its other daily contributed and properly called government research agency," Sherr said.

AFA selected Peter J. Schmitt, president and managing director of Bell, as the annual Jet Age Conference.

## Leasing Plan Proposed to USAF As Means of Modernizing Airlift

Dallas—Leasing of new turbine transport from private companies has been suggested as a means by which the Air Force could finance modernization and expansion of its airlift capability.

An Air Force leasing of turbine transport was proposed by Dr. Alvin R. Ferguson, director of research at Northwestern University Transportation Center, in the Air Force's consideration here at a planning in the shortage of modern airlift needed to support tactical forces in limited service.

The leasing scheme would allow the Air Force to acquire airlift capacity without a large investment in aircraft. The leasing scheme would allow the Air Force to acquire airlift capacity without a large investment in aircraft. The leasing scheme would allow the Air Force to acquire airlift capacity without a large investment in aircraft.

This plan could have some advantages to the Air Force and some disadvantages. The leasing scheme would allow the Air Force to acquire airlift capacity without a large investment in aircraft. The leasing scheme would allow the Air Force to acquire airlift capacity without a large investment in aircraft.

Under Dr. Ferguson's plan, a private contractor could lease the capital and low turbine transport from the aircraft manufacturers. Then this would be leased to the Air Force under one of a number of possible contracts. In one contract, the leasing firm would supply a complete aircraft or the leasing firm of the contract and take the airplane back when the contract expired.

Another method would provide a contract under which the private firm would lease the capital and low turbine transport from the aircraft manufacturers. Then this would be leased to the Air Force under one of a number of possible contracts. In one contract, the leasing firm would supply a complete aircraft or the leasing firm of the contract and take the airplane back when the contract expired.

Dr. Ferguson mentioned that a mod-

ern turbine-powered fleet would operate more efficiently than the present fleet of piston-powered aircraft and that the resulting economies would enable USAF to acquire a modern fleet of less than the present cost of operating the present fleet, yet would still be big enough to provide an adequate return to the leasing company.

Getting a need for the private industry to lease aircraft, the leasing company could be a valuable part of the government's leasing of aircraft. Dr. Ferguson suggested that the contract provide for a specific number over a period of several years. He said that the leasing company could be a valuable part of the government's leasing of aircraft. Dr. Ferguson suggested that the contract provide for a specific number over a period of several years.

In support of his plan, Dr. Ferguson pointed out that the present fleet of piston-powered aircraft is aging and that the present fleet of piston-powered aircraft is aging and that the present fleet of piston-powered aircraft is aging and that the present fleet of piston-powered aircraft is aging.

"Some of the Air Force might want to enlarge or change its airlift capability," Dr. Ferguson suggests contract provisions that would provide for flexibility. "In support of his plan, Dr. Ferguson pointed out that the present fleet of piston-powered aircraft is aging and that the present fleet of piston-powered aircraft is aging and that the present fleet of piston-powered aircraft is aging.

"The Government could lease the capital and low turbine transport from the aircraft manufacturers. Then this would be leased to the Air Force under one of a number of possible contracts. In one contract, the leasing firm would supply a complete aircraft or the leasing firm of the contract and take the airplane back when the contract expired.

Along with these advantages, Dr. Ferguson observed that procurement of modern aircraft would be a major task, but that the leasing of aircraft would be a major task, but that the leasing of aircraft would be a major task, but that the leasing of aircraft would be a major task.

# Gravity, Heat, Affect Space Cabin Design

By Irving Stone

Los Angeles—Long human experience provides the multitude of difficulties involved in space cabin design and operations were avoided here at the Symposium of Astronautics & Engineering, National Aeronautics meeting.

Gravitational and thermal design considerations with sealed cabins were not noted by E. G. Adams, Cosmos Division of General Dynamics Corp., Reading, Gt. Britain, on cabin design of such cabin as obtained in two weeks. Adams pointed out. Techniques of blood can be modified to reach peak values at protective equipment design can be improved so that current blood profiles do not tend to change to the limits of human capability.

Because obtaining low levels of  $G$ -loads during launch frequently involves inefficient fuel utilization, the protective equipment improvement approach is to get more structure from the cabin and less equipment. Adams declared, adding that some recent proposals involve a non-aerodynamic body, such as a large zero-lift closed sphere in which the atmosphere is free fall. Such a sphere, he said, would require less time heating and high  $G$ -loads.

## Immersion Concept

One approach to solve a small cabin problem under acceptance involved by Adams involves a procedure suggested by the German aerial jumbo and extended upon by Cosmos's Immersion Concept. This procedure—the "immersion concept"—involves a small capsule for producing a water breakthrough in this area, he declared.

There is, of man was immersed in a non-ditch tank filled with water. In addition to  $G$  loads, man would be subjected to various, particularly in those, circulate some heated water by blood displacement, that is, pressure and negative  $G$ . Adams holds that water provides parts of water and blood are quite similar, it was incorporated in water would experience no major blood displacement under very severe acceleration. Automatic investigations of these parameters are under test at Wright Air Development Center, and first reports are encouraging, Adams said.

From a human factors standpoint, weightlessness is one of the most frustrating conditions posed by space flight, Adams claimed. "It is certainly among the most difficult situations. It could have out to be the source of mental space flight or its greatest ally." We simply

do not know it. Theory and concepts will have to be our principal tools in studying human factors in space.

Even the North American X-15 can't be expected to provide more than a few minutes in the weightless state—a flight out from the 11 ft jet required for a single orbit of the earth. This means that an operational flight into space is likely to constitute the first engagement on the weightless state. Because of this, Adams pointed out, a sensible approach to the problem is to provide a means of substituting for the inertial force of gravity as possible within the sealed cabin.

Use of a spring lifting garment such as a full pressure suit can provide some of the man-made loads encountered on earth, Adams declared. Also use of constant tension springs, such as those used to regulate spring motors, would serve to add an artificial pull on the limbs. Use of weights in clothing would be less desirable, because of the discomforts such measures may encounter. Adams declared.

This problem of unaccelerated body movements must be given careful consideration in the design of sealed cabin systems. Adams explained. Use of free limb, restraint attached to the seat can be expected to add to a pilot's ability to orient himself, and on particularly long stay in space, where rest is required, comfortable restraints to prevent unaccustomed movements during sleep will be necessary.

Adams mentioned interesting space station by Dr. Antonov of Cosmos Division, which holds that different technological stages in the 2050 era will involve some form of a recolonization system more appropriate than a bed-and-bath pattern, so that space colonization can be achieved during the first stages of development during the 2050 era. He said that the system would involve drilled and low telecommunication reduced. "If something like this does occur, Adams pointed out, then the use of regular medicine instead for crew members may be a new concept.

Optimistic predictions mentioned in this transfer is anti- $G$  condition may be so rapid that the body will be unable to adjust. Absence of gravitational load on a pilot might induce computer-assisted, a pilot might be made to adjust to zero gravitation per condition—so that at physiological and biological diversities of the system were unable to achieve this level quickly, problems such as hypotension could occur.

Duration of disorientation following loss of gravity acting on mechanisms of the space can be a potentially serious

problem. After the first successful voyage of one descent into space, human factors studies will gain particular attention data gathered on this problem. Until then, Adams pointed out, probably the best design philosophy is to make it "as much like home" as possible.

Because of advantages in cost of capsule design and in providing restraint during weightlessness, the full pressure restraints garment has a high probability of being used in such systems. Adams pointed out, such garments will be the flight's duration. Recent advances by both Air Force and Navy in development of lightweight space suits give promise that devices up to one such suit be fabricated, tested and proved. Cosmos is currently testing this hypothesis with a Navy test available, Adams revealed.

## Capsule Temperature

Because it will not be necessary to hold the entire capsule in comfort levels, but only the ventilated space in the suit, solutions to cooling air requirements could be resolved. There is a limit to temperature which can be permitted in the capsule even with the pilot in a protective garment. This limit is set by the pilot's ability to withstand permissible heating, even during emergency, so that if it is at that level the pilot will become stressed. Adams pointed out. Cosmos is running tests over twelve-hour periods in a heated capsule structure with and without protective heating, comparing results with the 2050 era. The capsule is surrounded with radiant heat around 2500°. Such a temperature poses a danger that in event of failure, the suit can be readily removed by one suit. This requirement demands the development work on existing suits.

Adams called attention to thermal problems experienced during a series of tests in which it was discovered, in accident that equipment failure which could result in sudden increases in temperature could then constitute direct psychological as well as physiological problems. Visible temperature prediction of the human being is one too good to ignore. This temperature, and the perception of temperature changes in capsule, is one of the most difficult problems to solve. In the region of the least danger 70-100°F, human sensitivity to heat changes a fairly good. At more intense levels, 110-130°F, where danger is much greater, the perception of change is much more sluggish.

Adams revealed that when even a

small experienced a sudden increase in temperature in the 100-120° range, he showed physiological modification greatly in excess of the physical tests. Further investigation of human responses to such equipment failures is indicated, Adams declared, together with development for training for such emergencies. Addition of displays that inform the pilot of the air and radiant levels in the cabin could serve as a warning, he said.

Problems on operations and decomposition with sealed cabins were also stressed by E. B. Kerner, Douglas Aircraft Co. For short duration space flights, alternative means of providing artificial atmosphere could be possible with conventional oxygen systems, and chemical carbon dioxide absorbers. For long duration flights lasting weeks, months, or years, regenerative systems—biological, photochemical, or electrochemical of carbon dioxide with production of oxygen—will be required, because products will be involved in escape and weight, Kerner declared.

In two and a half years, these regenerative systems should be supported to obtain a practical biological or photochemical closed ecological food-water cycle system, he said. Adams, experienced in closed planetary systems, stressed the design of carbon dioxide with artificial light and means of oxygen for use in the cabin should be explored, because there is an abundance of hot ultraviolet light in space, he said.

Thermal control in a manned man environment for extended space flight operations. Loads through structure and seals only need to be more important than mechanical problems. Kerner mentioned development of systems that are not possible on space cabins, but will have to be calculated precisely so that adequate energy reserves be stored. The longer the exposure of the cabin in space, the greater will be the probability of a penetrating hit by a meteoroid. In general, specified meteoroid holes will be very small, but in general excessive loss of oxygen, toxic fumes will have to be detected and isolated quickly, Kerner declared.

Other brief reports of space cabin design were outlined by Alfred M. Myers, chief engineer and safety representative, Douglas Aircraft Co.'s El Segundo Division.

As automatic controls are further perfected, there will be a decreasing need to depend on human operation for manual control in routine situations. But there will be a need for human intervention in the event of a disaster, such as a fire, a malfunctioning of the oxygen system, a malfunctioning of the emergency control and repair to make effective use of such space vehicles.

Design of the cabin can most directly be met with the aid of the astronaut. Data to which an environment con-

ditions to data showing and unusual human behavior can be measured, will be a major determining factor in ultimate evaluation of the total vehicle, Myers emphasized.

A fire testing program of measuring and experimentation will be required to define space radiation environment and determine shielding needs. High acceleration weight materials should be used as shielding against heat energy. X-rays and gamma rays only after it has been determined that such will not not adequately approximate the effect of high energy particles of value as cosmic rays by causing secondary emissions. Myers stated.

During free space flight a different system will be needed than that which would be employed for temperature control during atmospheric portions at space flight. Kerner mentioned two types of heat pumps for the transfer of heat to and from external radiation surfaces. One is an extension of normal refrigeration practice in which a working fluid is used to absorb heat and transfer it to an external heat sink. Temperature is a radiating surface. Another method is based on use of an thermoelectric materials, where heat can be absorbed as a cold junction by means of electric current through the material.

Noises and vibrations generated by the propulsion system, aerodynamic and equipment are expected to fall greatly within values on which man can tolerate. Control techniques now in use as standard are likely to be effective in providing adequate vibration, Myers declared.

Storage of gases in chemical form is necessary for development of systems that are a good approach to the problem of

## NASA Gets Moon, Satellite Shots

Washington—National Aeronautics and Space Administration has an operating space test week, formally, taking over during U.S. 5-hour probes and the National Aeronautics and Space Administration's "Vanguard" program, from Defense Department agencies. Detailed plans for NASA were issued by the new agency were reported by Aviation Week on Aug. 11.

Immediately after its establishment by presidential proclamation on Oct. 1, the nation's new civilian space agency assumed responsibility for basic research programs for the development of space technology in general, including the 1.5 billion to drive single-chamber engine study and development program formerly administered by the Air Force. In addition, NASA and Defense Department's Advanced Research Projects Agency will work together in a program to put man into space.

Some new emergency, if employed with suitable safety and cooling methods, he said. More advanced studies utilizing ships and other biological organisms, and chemical experimentation, will be required to provide a valid, potentially satisfactory approach to provide effective long-term control of external atmosphere.

Storage of food and water supplies coupled with a waste disposal system on a continuously state needs at that and intermediate duration operations. Myers claimed, but for long-term operations integrated ecological systems, although complex, may be possible. Myers stated. Moon descent suits a system based on biochemical structures. Possible future availability of electric power from nuclear systems shows promise of providing enough energy in the form of light to cause power low-light photosynthetic devices, he declared, and various chemical regeneration processes also show promise.

More described a speculative approach to a system of space station in a "space station." The control unit is designed to permit one man to monitor the station and the necessary controls. The compensation unit, lubrication, irrigation and living quarters are provided. The station is designed to provide environmental and psychological environmental requirements for both man and all data crew members.

Despite losses and such equipment as man is provided to permit large reliability gains, advanced when maintenance and part replacement can be done during various operations. Constant comparison of alternatives of self-reliance will be compared with the results of the experiments, he said, in a head-on direction.

NASA will continue to direct progress begun by its predecessor, the National Aeronautics Committee for Aeronautics, which moved to meet at the National Aeronautics and Space Administration. Personnel and facilities as well as functions of the 49-year-old NASA were absorbed by the new agency.

These are the projects transferred to NASA last week in the Defense Department on transfer.

• **Project Vanguard.** NASA takes over responsibility for the new research earth satellite vehicles scheduled to be launched by U.S. plus other elements of the space program in general. Geophysical Year, from the Naval Research Laboratory. The results also will include approximately 150 civilian scientific personnel, including Dr. John P. Hagen, who will continue to direct the program. The results will be shared with NASA after the termina-



time of the Vanguard program. Because of the lack of nuclear facilities within the Washington area, the Naval Research Laboratory will continue to house the Vanguard program and its variants. Congress cut from NASA's Fiscal 1959 budget a request for \$5.75 million for the construction of a Space Proving Ground at Beltsville, Md. (AVD Aug. 16 p. 27).

The Vanguard program will be funded according to the procedural regulations for such projects as will be determined by the director of the Bureau of the Budget.

• **Four-hour probes** now scheduled two of which had been assigned to the Air Force Ballistic Missile Division and two to the Army Ballistic Missile Agency. Dr. T. Keith Glennan, NASA administrator, said last week that his agency would assume technical supervision of the program but that preparation and actual flights will still be conducted under the direction of the two services.

• **Three satellite projects** formerly assigned to Army's Ballistic Missile Agency, in place, into orbit two satellite altimeters (weight over 11 lb) in January, the other 100 lb and both developed by NACA—plus a cosmic-ray satellite. Launching of the 100-lb sphere scheduled in late 1958 or 1959 may be the first step in NASA's plans for launching advanced communications satellites.

• **Engine development research** program, assuming USAF support of the Rocket motor rocket development and work on atomic engines.

#### X-15 Test Flights

NASA will continue the work, owned as by NACA, in the development and test flights of the X-15 high-altitude research vehicle being produced by North American Aviation.

The project has been sponsored by Air Force Navy and NACA.

Total cost of the nuclear probes and Army satellites is approximately \$55.5 million, most of which was funded in Fiscal 1958. 11 out of 190 funds needed to complete the program \$9.6 million, will be transferred from ARPA to NASA. ARPA also will be asked upon to transfer another \$48.5 million to NASA to continue a number of other satellite projects.

To fund the major projects now on duty as approximately NASA will receive \$15.5 million from the Air Force.

A Defense Department spokesman said last week that the Advanced Research Projects Agency will continue work on a number of defense projects, including air missile defense and satellite propulsion and satellite propulsion, including warning, navigation, reconnaissance and intelligence systems. The ARPA budget for Fiscal 1959 after the transfer to NASA is approximately \$120 million.



FIREBALL issue from second shot in the second series of rocket tests.

## Second Nuclear Test Shot Fired

Mesero, N.M.—Second full-scale test on the second series here was detonation of a 100-kiloton fusion bomb suspended from a captive balloon, 1,700 ft above ground level. The test was run by Los Alamos Scientific Laboratory.

The blast was seen, visible from 25 miles away, reported from a host of tall hills because atmospheric conditions were excellent for transmission of shock waves. Blast wave is accurately recorded by microphotography at the control point 11 mi from ground zero was 15 miles. Some experienced observers 10 mi from the fireball considered the blast stronger than others that left less than 100 ft from the fireball.

Flight observers which include observers remembered being reported at control point is 24 kilometers. A Los Alamos scientist called the blast as example of the difficulty of making him tell estimates of nuclear blast effects.

The second test was conducted near a New Mexico county. Seven light frame houses were used as

civil effects studies to obtain additional information on radiation shielding of buildings in structures for construction with damage done at Hiroshima and Nagasaki World War II. Houses were located to simulate, light Japanese, construction. Water filled culvert was used to study the angular distribution of radiation.

An eleven-page on the day military equipment also was conducted.

The detonation was heard at Lovington, Calif., as a low rumble. Other observing points reported that no sound was heard.

The fireball had the hemispherical shape typical of fusion shots. The cloud rose to about 11,500 ft and drifted south, directly over the control point and Mesero, N.M. Observers were estimated within 10 mi. After the shot and test site was surrounded at the control point returned within about 10 mi and those at Mesero about one hour after the cloud began its passage south.

## Possible Pilot Error Suggested In KC-135 Record-Attempt Crash

Washington—Air Force investigators last week suggested possible pilot error as the cause of the June 27 crash of a KC-135 jet tanker on takeoff from Western Air Base, Md.

Crew of the Boeing aircraft claimed the loss of 15 persons, including seven crew members, two National Aeronautics and Space Administration observers, two ground crew members and two passengers. The crash occurred while a flight of four KC-135s (JAW July 7 p. 37). Two other jet tankers departed successfully and established altitude. The fourth flight was cancelled because of the accident.

Conflicting eyewitness accounts at the time of the accident that the tanker exploded or caught fire in motion were received by the official Air Force investigation report which found no evidence of mechanical or structural failure.

Witnesses shown over a three-mile area approximately one mile from the end of the runway was the result of impact alone, Air Force investigators said.

Their summary of the accident, however, did not take note of further eyewitness testimony that the heavily laden jet, carrying sufficient fuel for a month's flying between the U. S. and England, appeared to be climbing at a lower angle than normal for KC-135s being at low gross weight.

#### Fuel Analysis

Fuel analysis of the accident in the Air Force tests concluded that the pilot was late in concentrating on his air speed indicator long enough for the tanker to assume an unexpected four degree descent angle. That possibility arose during the climbout flight was attributed to "the result of complex loads on aircraft handling techniques compounded by flight instrument line failure."

Reconstructing the accident, the Air Force said the four-engine tanker carried a net maximum gross weight of 250,000 lb because of its long nose tip fuel tank. Based upon a fuel tank air temperature of 170° and a flap setting of 30 deg., the expected takeoff ground roll distance was calculated at 10,000 ft.

Four hours before takeoff the temperature at departure time was predicted to climb to high at 72°, necessitating a flap change to 40 deg., to decrease takeoff distance to 9,500 ft, the report said. Pilots of the first two tankers, carrying lower gross weights, had successfully used a 30 deg. flap setting.

Weather conditions were reported as a bruise cloud layer at 700 ft, a 10,000 ft ceiling, takeoff runway visibility of one-and-a-half miles in fog, susceptibility of 71E and a wind of gusts from 220 deg.

While observers on the ground and the tanker's engines sounded as though they were operating abnormally, they added that the KC-135 did not become airborne until after using more than 10,000 ft of runway.

The tanker's climbout angle seemed flatter than normal, Air Force investigators said.

Although the plane cleared tree tops 26 ft high at a distance of 3,300 ft from the end of the runway, it failed to clear trees about 15 ft above the runway elevation at a point 4,930 ft from the runway end.

After the initial report of its left wing and engine, the aircraft tumbled in additional 700 ft before crashing.

Left bank of north 30 deg., right striking tree tops, then plunging through air resistance power cables and finally crashing during a nose vertical left turn. The plane was completely consumed by ground fire.

No communication was received from the plane between the loss of takeoff roll and crash.

#### Flap Setting

In a full discussion of the crash, the report emphasized that the flight could not be explained "because of the KC-135's high gross weight, near-gust weather conditions, darkness and use of the 40 deg. flap setting."

Noting that accuracy of the flap angle to reduce takeoff ground roll distance seemed a calculated possibility of a more shallow climbout angle path, the investigation emphasized that the flight crew was aware that the flap would have to be extended to a reduced setting as soon after takeoff as possible. The short time between becoming airborne and crashing precluded any flap retraction and examination of the wreckage revealed that the flaps were still at their output 40 deg. setting.



Drone Camera Photographs Bamarac Approach

Approach of a Boeing B-57 bomber is photographed automatically from a B-17 drone flying at the altitude of one mile over the B-17's engine nozzle. Bamarac's approach has not demonstrated a striking change (upper right), while spot of smoke indicates the moment the aircraft's engine would have exploded if the engine had been used. Bamarac's 145 ft, wide-angle lens covers distance. First leg of Bamarac was made at Cape Canaveral, Fla.



## Manufacturers Attack CAA Engine Ruling

New decision decentralizing the type certification of engines draws bitter criticism from industry.

By L. L. Doty

Washington—Most in the Civil Aeronautics Administration are confident today that certification of aircraft engines has drawn a better picture from manufacturers and has brought into the open a strong industry attack against the agency's Office of Flight Operations and Aerodynamics.

Growing discontent among engine and propeller manufacturers with what they term "some of the administrative policies of the CAA" has been brewing for at least 10 months and now appears to be centered on "Propag," the name tagged on the Flight Operations and Aerodynamics Office several years ago without any apparent logical basis.

### Effective Last Month

The program to decentralize certification activities which has been planned for slightly less than a year and was put into effect last month, triggered industry's attack against the office. Before the attack had been a long-simmering resentment on the part of industry against alleged delays in the work flow through the office on certification matters.

To a result, the degree of resentment toward the decentralization program varies widely among the industry, with

the propeller and engine manufacturers on the left. However, industry officials generally feel that the introduction of the program on the eve of the implementation of the Federal Aviation Act (see page 41) was possibly more on a hot than a cold basis.

The decentralization plan has then developed into a principal target for industry leaders who wish to see the Federal Aviation Agency launched without inheriting any preformed changes not to their liking.

Changes against decentralization came to a head last February when the Aircraft Industries Assn. made its first major attempt to have the proposed plan dropped. At that time, the CAA's Office of Aeronautics Committee called on Sen. Keating, chairman of the Flight Operations and Aerodynamics Office, to outline industry's objections to the plan but reported back that the meeting was "highly satisfactory."

Subsequent attempts to decelerate "Propag" from holding its position on the plan failed, but last month engine specialists were transferred from Washington to two of CAA's five domestic regions. The other two regions, according to CAA, are already staffed to meet the needs of the engine manufacturers located in those areas.

CAA gives its members that engine who have been working on specific engine certification projects are being reassigned to handle the same projects in the field. Nevertheless, AIA held firm in its strong opposition to the plan.

Here are the industry's chief arguments against decentralization:

- Industry wants a centralized agency with which manufacturers can deal on an equal basis.
- Manufacturers emphasize that engine certification is a "multidisciplinary" and should be handled by experienced personnel with the strong background and knowledge gained by working on all engine models over a long period of time. Manufacturers are opposed that decentralization will require additional personnel who may not have sufficient working experience.
- Type certification of small engines is mostly done on a consignment basis with the building of new models of aircraft and according to AIA, "one manufacturer might be placed in a more favorable competitive position if he were able to get quick action on certification matters" under a regional arrangement.
- Earlier decentralization arrangements was abandoned about 10 years ago because of the "unrestrained delays and confusion" resulting from the process.
- Division of responsibility would not develop from the need of manufacturers to consult with specialists in such subject areas as vibration.
- Overcentralization will "inevitably" require considerable duplication of personnel with increased expense to the government and increased cost to the industry and coordination difficulties to the industry.

### 'Propag' Rebuttal

In his reply to these arguments against decentralization, Keating explained that structure for the issuance of a type certificate are contained in Civil Air Regulations, Part 15, which prohibits the possibility of dealing with the various manufacturers on an equal basis.

He added that issuance of type certification that is governed by more complex regulations "do not give an easy means to believe some manufacturers will seek." He gave his assurance that only personnel who have worked in specific areas "for many years" will be transferred to the region to do "the benefit to your industry of this

experience of these people will not be lost."

On the point of certification of small engines, Keating said:

"I am aware that it is the practice to develop small engines and airplanes in which they are to be installed." He said, however, that there have been cases in which AIA's action was completed six months before the engine manufacturer was ready to demonstrate the engine for certification and added: "In any case, the Civil Aeronautics Act gives us an authority to act as an agency in such competitive matters."

Referring to the argument that past experience with decentralization was unsatisfactory, Keating said, "I am not sure of any unnecessary delays and confusion arising from a similar procedure in the past."

He admitted that in certain subject areas it would be necessary to consult with specialists but added to explain that this step would result in a decrease of accessibility. He added:

"This practice also is necessary in the type certification of aircraft, but the responsibility for working when what our action is necessary and for the decision to issue an airworthiness type certificate will rest with the Civil Aeronautics Engineering Division, in the appropriate expert office."

He could not explain arguments by emphasizing that "we believe that decentralization will permit more prompt handling of applications for engine type certification without any increase in the total time involved."

In summarizing his final decision to decentralize, Keating told the Aircraft Industries Assn. that the "continuity" of relations between manufacturers and the CAA will not be disrupted. He assured the association that all activities are being "coordinated" with the various regions "to ensure continued efficient and uniform administration of all engine type certification projects." He added:

"To further insure that efficiency of this operation will be maintained, Type Board meetings as all major engine type certification programs will be conducted by the agency and Washington personnel will participate in these meetings."

One CAA spokesman suggested that some of the differences on decentralization may stem from industry's discontent within "Propag." He said the program may have helped to view personnel in a different light and that some personnel would be transferred to the region to do "the benefit to your industry of this

experience of these people will not be lost."

On the point of certification of small engines, Keating said:

"I am aware that it is the practice to develop small engines and airplanes in which they are to be installed." He said, however, that there have been cases in which AIA's action was completed six months before the engine manufacturer was ready to demonstrate the engine for certification and added: "In any case, the Civil Aeronautics Act gives us an authority to act as an agency in such competitive matters."

Referring to the argument that past experience with decentralization was unsatisfactory, Keating said, "I am not sure of any unnecessary delays and confusion arising from a similar procedure in the past."

He admitted that in certain subject areas it would be necessary to consult with specialists but added to explain that this step would result in a decrease of accessibility. He added:

"This practice also is necessary in the type certification of aircraft, but the responsibility for working when what our action is necessary and for the decision to issue an airworthiness type certificate will rest with the Civil Aeronautics Engineering Division, in the appropriate expert office."

He could not explain arguments by emphasizing that "we believe that decentralization will permit more prompt handling of applications for engine type certification without any increase in the total time involved."

In summarizing his final decision to decentralize, Keating told the Aircraft Industries Assn. that the "continuity" of relations between manufacturers and the CAA will not be disrupted. He assured the association that all activities are being "coordinated" with the various regions "to ensure continued efficient and uniform administration of all engine type certification projects." He added:

"To further insure that efficiency of this operation will be maintained, Type Board meetings as all major engine type certification programs will be conducted by the agency and Washington personnel will participate in these meetings."

One CAA spokesman suggested that some of the differences on decentralization may stem from industry's discontent within "Propag." He said the program may have helped to view personnel in a different light and that some personnel would be transferred to the region to do "the benefit to your industry of this

experience of these people will not be lost."

On the point of certification of small engines, Keating said:

"I am aware that it is the practice to develop small engines and airplanes in which they are to be installed." He said, however, that there have been cases in which AIA's action was completed six months before the engine manufacturer was ready to demonstrate the engine for certification and added: "In any case, the Civil Aeronautics Act gives us an authority to act as an agency in such competitive matters."

Referring to the argument that past experience with decentralization was unsatisfactory, Keating said, "I am not sure of any unnecessary delays and confusion arising from a similar procedure in the past."

He admitted that in certain subject areas it would be necessary to consult with specialists but added to explain that this step would result in a decrease of accessibility. He added:

"This practice also is necessary in the type certification of aircraft, but the responsibility for working when what our action is necessary and for the decision to issue an airworthiness type certificate will rest with the Civil Aeronautics Engineering Division, in the appropriate expert office."

He could not explain arguments by emphasizing that "we believe that decentralization will permit more prompt handling of applications for engine type certification without any increase in the total time involved."

his best to know a considerable shift, and thus no knowledge of the role the various CAA offices play in the certification process of the Federal Aviation Agency.

First duty plus for the FAA staff on engineers, known as the "waste paper basket" role, was not conducted among CAA program divisions.

It did not, however, suggest widespread changes would be involved in the CAA structure as the agency was fitted into FAA.

## Continental Withdraws Fare Bid

Washington—Civil Aeronautics Board last week rejected the bid, phase of a Continental Airlines "package" involving by voting three to two its suspension and investigation of the carrier's proposed to increase its first-class and coach fares by an estimated 6%.

Rejection of the airline's last proposal, which was approved, calls for a 24% reduction in regional coach fares, extension of the family fare plan and special winter fares for certain family groups. However, Continental had requested approval on the basis of a package deal and elected to withdraw the entire application.

As submitted to the Board, the fare plan requested the CAA increase, combined with extension of the family fare plan from the present Monday through Sunday fare to include Saturday and Sunday fares to coach fares. The plan also included a 24% increase in first-class fares and a 6% increase in coach fares. The plan also included a 24% increase in first-class fares and a 6% increase in coach fares.

In further argument, TWA noted that Continental's proposal to use a 90-day advance booking period for its "Economy Class Club" fare at \$64 on daily aircraft DOT flights between Los Angeles and Chicago with family members to pay \$68.

Following the 6% fare increase was Chairman James H. Doolittle and member Louis F. Brehm agreed the majority vote of Vice Chairman Clay Casper and members Hiram D. Dwyer and G. Victor Moore. Board approval of the increase on a vote of 3-2.

In a five-page opinion outlining the Board's failure to adopt the entire plan, Brehm noted the decision is "a severe blow" to the airline industry and pointed out the Continental proposal in the "most realistic, realistic set of tariffs filed with the Board in many months."

Continental's "refreshing" new approach to the pricing problem of increasing its traffic, Brehm said, should have been "highly commensurate" by the Civil Aeronautics Board as an attempt to adjust standard "airline business practice" in the face of de-

creasing business profits and airline volume.

He noted that the voting pattern of the Board on this matter seemed to "place it on end center," unable to approve any fare system combining fare increases with potential discounts. "I cannot believe that this happens merely on a contract in the face of the urgent problems of the industry," he added. Offered by Continental as an experimental measure designed to attract more revenue from the airline's automobile travelers, the suggested fare reductions brought immediate protests from Trans World Airlines as being unjust and discriminatory.

TWA told the board that any move by Continental to apply its low 50¢ fare would leave TWA, along with United and American, to match the reduced fare on the same route as a competitive measure. Questioning the airline's proposal, Trans World estimated it would lose \$486,000 on the Chicago-Los Angeles route alone if it were permitted to adopt the fare.

In further argument, TWA noted that Continental's proposal to use a 90-day advance booking period for its "Economy Class Club" fare at \$64 on daily aircraft DOT flights between Los Angeles and Chicago with family members to pay \$68.

## Flying Tiger Acquires Two Constellations

Flying Tiger Line has bought two new Lockheed L-104 Constellations, scheduled for delivery last week. Total fleet of the airline is 31 6 planes.

The cargo and contract cargo and one of the new aircraft will go into the domestic scheduled cargo service, the other into contract cargo work for Military Air Transport Service. With the two new aircraft, the Flying Tiger fleet comprises 14 Super H's.

Flight traffic has shown an average increase of 19% in 1953 on Flying Tiger routes, the airline said.



Soviet Tu-114D Flies to Prague

Soviet Tupolev Tu-114D transport plane flies to Prague, Czechoslovakia, in the first test flight south. The aircraft, flown from the Tu-155 long-range bomber, was photographed in flight over Prague Airport. Aircraft has a 130 ft. wingspan and weighs 240,000 lb. The Tu-114D is equipped with four Kuznetsov NK-12 turboprops.



# AIR FRANCE



## Let's get one thing straight about pilots!

If your mental picture of an airline pilot is a romantic, leading-liner-forget-it! You've been seeing too many movies. Captain Alfred Dumas, a real Air France pilot, frankly admits that he's no romance id. He doesn't have time to play here and there. For more than 30 years he's flown Air France airplanes all over the world. Now Captain Dumas flies new Air France Super Starliners across the North Atlantic from New York to Paris. It takes precise coordination and

excellent cooperation to pilot a giant airliner safely for over a million miles. No job for a glutton for just a perfect job for tonight pilots—the kind of pilots who have helped to make Air France the world's largest airline.



Strong & steady as the leader, Air France pilots & crew members fly the world's largest airline.

**WORLD'S LARGEST AIRLINE / WORLD'S MOST PERSONAL SERVICE**

usual, must work for the U.S. Air Force in their facilities. All Comet maintenance and overhaul except spare overhaul will be done by the airline, and its tooling up to handle that kind of the Rafal Boreon program in 1970. Cost of tooling and equipment for the Comet program will approximate \$100,000, Air France West was told.

### International Schedules

Aerolineas plans to maintain its international schedules for a while at about the same level as presently flown, at least initially and. Domestic expansion would certainly follow an explanation, they added. Long-term thinking is clearly the possibility of Pacific routes.

International competition from Transcontinental could be judged on the private carrier has been the more eager, but domestic competition from the new airlines is being left. Aero line acknowledges. Over the international routes, competition from current not adding to IATA standards was considered as a problem.

Aerolineas then was really competing in Europe, then in New York. Last factors to Europe are 1970, during the March through September peak season, the airline was, and fell to about 10% in the off season. New York route average load factor is 85%. Various competitors on some of the regional routes has drastically cut Aerolineas' load factors—for example, planes that used to be full in Chile now are down to about a 40% load factor. A problem for all Argentine carriers is the country's rate structure, presently pegged by law at around two cents per mile, according to officials of the airline. This point was stressed by officials of another new private carrier, Aerol.

Modestly equipped with three C-46s, one in cargo service to Miami and the other two as passenger runs within Argentina, Aerol is a new subsidiary of two well-known Argentine firms, Leon de Rodas and Mercedes Rodas.

It seems from the companies' control given and estate, chemical automobile and shipping interests. Aerol would like to expand that by acquiring two more C-46s, then purchasing additional DC-6s or Convair-type equipment, three, in four or five years, buying surplus planes. But before buying any additional equipment, it must get a government permit to export, and the airline says this involves several months' time.

Aerol paid \$278,000 each for its T-46s and C-46 conversions. \$128,000 for the cargo C-46, Aerol West was told.

Aerol officials said that cooperation of government policy could be a

problem for the private carriers. They would like a clear definition of policy, extent of the rate structure, and growth supported airports and airport facilities, among other things. Aerol, like the other carriers, hopes to expand because alternate airports are widely spread and extra gas must be carried to make up for this. Other deficiencies of the facilities do not make life any easier for the carriers, of course.

Argentina's border traffic for the airlines has not reached usable proportions to let, partly because of the distances from big tourist generating points and partly because of border facilities and the lack of an aid of expansion. Aerolineas estimates that less than a third of its domestic passengers are tourists here and that a considerably smaller per cent of its international travelers are tourists.

Absent of the jet transport, which will get right now from the United States, should certainly aid in the development of the country's tourist in tourism, and boost the source of airline traffic.

Argentine tourism potential, the country's President Arturo Frondesi and last month at a press conference in Buenos Aires, is 5.5 million a year. But better transportation and more hotels are needed.

President Frondesi told Aerolineas West that development of commercial aviation is dependent on Argentina's foreign exchange reserves. The government wants to develop aviation, he said, but any specific program must be subject to the country's economic capabilities.

## Northeast Files Bid To Block Lease Plan

Washington—Fighting to block further competition on its New York Florida route, Northeast Airlines has asked the Civil Aeronautics Board to reject a proposed equipment lease and stock option agreement between Pan American and Pin American airlines.

Rebusing the proposal as a "master plan" designed to put control of Northeast, attorneys for Northeast announced Board members that they had rejected Pan American as a competitor on the New York Florida Case two years ago on grounds that the carrier's capabilities would have a "disastrous" effect on other airlines in the market. "Permitting" the C-46 conversion in the near future, was a loss for Pan American, with its financial and equipment resources, large water main capacity, and ability to control South American and European connecting passengers. Enough scheduling would "make its carrier competitive."

Eastern Air Lines, the third carrier to

fight the New York Florida route, already has filed a complaint with the CAB (AW Sept. 28, p. 10). Northeast said it is making filing for minutes (AW Sept. 22, p. 10) that the carrier's route alone would have a loss of more than \$2.6 million last year.

Board arguments offered by Northeast for dismissal of the Pin American National program of the airline to share of Eastern's route controls that the agreement would violate Section 405 of the Civil Aeronautics Act regarding CAB approval of acquisition of control of an air carrier.

Such control, Eastern attorneys contend, could mean share in such as Nov. 7 when National stockholders vote on the delivery of 400,000 shares, or 26%, of the airline's stock, to Pan American. Pin American also has an option to purchase an additional 125,000 shares within the next three years, the attorneys said.

Rebusing the recent Possible Coasian Contract Case involving Harvard Hughes, Twin World Airlines, the Alou Corp and Northeast, attorneys for Northeast pointed out that the owner ship of 11% of the stock of the Alou Corp, which includes Northeast, is Harvard Hughes was sponsored by the Civil Aeronautics Board.

Pin American's acquisition of 400,000 shares plus an option on another 125,000 would be held by a member not voted with the majority, they pointed out. While this arrangement "ought" legally would be "control," Northeast said, such action would have serious to the stockholders' disapproval with Pin American that they do "let their own speak."

A further stipulation of the proposal also allows Pin American to drop its planned lease of jet aircraft to National if the stock exchange is not approved by the stockholders.

Northeast also contended that the short-term lease of Boeing 707-321 jets to National for the next two winter beginning Dec. 10 is aimed at identifying Pin American with the New York Florida market and "steering the carrier" from that market. The airline's attorneys also said that, with the assets and all ground equipment serving the lower air carrying Pin American planes—while National's only ability would be a ground control inside the place—public acceptance of Pin American on the route would be hindered, thus providing the carrier with a basis for its own case to the CAB. The airline's attorneys also said that, under the terms of a lease to ground control of National.

Adding to the competitive picture, the Northeast attorneys said, is Pin American's ability to funnel its international passengers onto the New York Florida route from other cities and its role in managing its own schedules at those in Northeast.



Fairy Rotodyne takes off at Farnborough with payload at top thrust. Now gas struts flexed

## Rotodyne Demonstrates VTOL Features,



Now climb! then fold outward for drive-in loading. Payload will be built with 50% loadout, replacing present 6-8.



Fourier Effect gas turbine engines are Rotodyne's power source down, Roman Aircraft Corp. is U.S. licensee.



## Cargo Lifting



Now top position pfs have Fairy-developed rotor supports to reduce horsepower needs. Farnborough takeoffs now dashed by main rotor or takeoffs of the Fairy Deltic 2 delta wing aircraft. When gas turbine engines drive the air compressor which feed shafting pfs.



Now system shown has down stability for glide. Payloads done in behind cockpit. Rotodyne model (below) is not easy to show, present testing configuration.





## Imagine getting an airline reservation in just 2 seconds!

The lag speed-up in reservation service is coming—soon! Soon Western Airlines will use electronic to end tedious waiting. Soon, you can call or visit a Western ticket office or terminal, and in only two seconds your reservationist will tell you whether space is available on any Western flight—and reserve it for you! This astounding speed is made possible with "Resetree," the electronic reservation system designed and engineered by Western Airlines and the Telegator Corporation. Resetree will be operating soon on a system-wide basis...and only Western has Resetree.

Instantly, Resetree will flash information

about flights throughout Western's 9000 miles of air routes in the 18 Western states, Canada, and Mexico.

Watch for it. You'll find Resetree another of the thoughtful services that help make Western the wonderful way to fly!

Among the major cities served by Western are: Los Angeles, San Francisco, Oakland, Portland, Seattle-Tacoma, Minneapolis-St. Paul, Denver, Salt Lake, Las Vegas, Reno, Phoenix, San Diego and Mexico City.

## WESTERN AIRLINES

## Elwood Quesada Named to Head New Federal Aviation Agency

Washington—President Eisenhower last week named his chief aviation adviser, Elwood R. Quesada, as administrator of the Federal Aviation Agency. The appointment, announced by Air Force Sec. James C. Pyle, is effective Nov. 1, 1960.

Under the provisions of the Federal Aviation Act of 1958 passed during the closing hours of the last session of Congress, the new agency is to be completely organized 60 days after the signing of the administration.

Then within that Quesada will have 90 days, or until Jan. 1, to lay out the plans for the new federal aviation agency. At that time, all government aviation agencies except the CAB will be absorbed by one man for the first time in U. S. aviation history.

The agency will be headquartered in Washington at 1775 St. and New York Ave. in the old Enterprise Hospital Building. Location of offices and departments in the building will be determined by the staff organizational pattern Quesada and his aides establish during the next 90 days. Key personnel will be chosen during this period.

No deputy administrator was named in the official announcement of Quesada's appointment, but it is understood that James C. Pyle, Civil Aviation Administration Administrator, will be offered the post on Jan. 1. The delay in Pyle's appointment is designed to keep the CAA's strength intact during the 90-day interim period.

Airways Modernization Board probably will operate without a chairman for the balance of its history. The Board, which has been headed by Quesada since its inception, was created to oversee research and development on jet propulsion, the establishment of the FAA and will be absorbed by the new agency on Jan. 1.

In addition to planning the structural pattern of the new agency, Quesada and his staff will prepare new civil airport construction legislation for the next session of Congress. At the same time, Quesada will study recommendations in Congress for legislation covering jet

aircraft requirements. The Act calls for these on or before Jan. 1, 1960.

Under the provisions of the act, Quesada will be assigned to assign key personnel to head the new agency. He is the chief of the regular Air Force before Nov. 1. The decision to take such a step was Quesada's own. Although he has been the logical choice for the post, he was never asked by Eisenhower or the President's close aides to resign his commission.

On this point, the President said, "Mr. Quesada's organization represents a mixture which I feel reflects his high-level guidance." He urged Congress to restore his commission and add:

"The fact that a man of Mr. Quesada's qualifications is obliged to resign his regular status as a regular Air Force is to comply with the letter of the law so he can again serve his country does not, in my opinion, seem logical or desirable."

## U. S. Sponsors Vortec Symposium

Washington—Representation of 30 member nations of the International Civil Aviation Organization (ICAO) attended a four-day symposium and demonstration of Vortec line and its radio system last week. The symposium was sponsored by the U. S. government.

Purpose of the meeting was to better acquaint aviation authorities from ICAO nations with the characteristics, operational use and advantages of Vortec in preparation for the February 1961 ICAO meeting in Montreal where it will seek to have Vortec established as an international standard short-range navigation aid.

The day before the U. S. symposium, British, Canadian, U. S. and Civil Aviation authorities planned for a series of demonstration flights of six competing Decca systems and the Decca long range navigation system in Europe and in North America.

In 1949, ICAO adopted VOR as an international standard for terminal area navigation where traffic density and low visibility required. In 1951, ICAO adopted U. S. developed and distance measuring equipment (DME) as a second international standard, where such aid was required by traffic densities. With the subsequent U. S. switch from civil DME to Decca-compatible DME (DMET), a corresponding change in ICAO standards is required to add that, the U. S. seeks to obtain ICAO

adoption of Vortec as a standard in remote navigation aid as well as for the usual area use. Britain, whose own Decca long frequency hyperbolic navigation system earlier lost out to VOR, DME, is expected to urge ICAO to reject Vortec in favor of Decca.

Civil Aeronautics Administration James V. Pyle summed up highlights of the U. S. position for Vortec in his presentation to the symposium:

- Present ICAO Standard VOR already is an widespread use. Existing ICAO regional plans and domestic plans of member nations already call for installation of more than 100 VOR stations.
- DME that are outside the U. S. represent nearly half of these stations already are installed and in use.
- Combination of VOR and DME (Vortec) can provide precise, consistent track guidance, "semiprecise" in, and "terminal" in; in reference to Decca whose operation at low frequencies make it more acceptable to three-phase disturbance than Vortec, which consists of very low frequency.
- Flexibility of Vortec system means that a nation can use VORs to meet the DME's facility only if and where it has traffic density or traffic control problems that are within its added benefits of the distance measuring capability. Pyle said he is confident that the U. S. "does not and will not expect any other nation to install any facilities beyond those required to discharge their nation's self-assessed obligations to far such an navigation system."

Pyle pointed out that the approach made 300 mi range of Vortec with its single-site installation, is ideally suited to existing station locations. It means that the navigation system is based under the control of each country which has the responsibility for funding the air navigation system. (In contrast, Decca requires establishment of a number of stations, which are considerably greater area, which makes it more difficult for individual air nations to total service to their own needs.)

The CAA Administrator and the U. S. representative of the International Civil Aviation Organization (ICAO) will be the introduction of DMET for the annual civil distance measuring equipment, with extension of the production date beyond the coming date of Jan. 1, 1961, which now applies only to VOR.

David D. Thomas, director of CAA's Office of Air Traffic Control, pointed up the need for a single international standard navigation aid.

The alternative to continuation of the present U. S. standard of VOR, Pyle said, is to demand universal VOR, an action he planned, along a different standard, then go through the necessary planning and implementation, or the superimposed standard that may be set as an additional standard on the existing VOR system.

### Correction

Airbus Work reference to a North-west Airlines order for Lockheed Electra 440s is in error for the reference at the Atlantic stage of the buydown credit in the Sept. 29 issue (p. 30) was in error. The order referred to should have read Northwest Airlines Airbus Work repeat the error.

## MASTER OF THE HIGH MACH!...



### AERONCA STAINLESS STEEL HONEYCOMB STRUCTURES



HIGH FREQUENCY VIBRATION TESTS prove ability of Aeronca bonded honeycomb to withstand high acoustic energy levels.



HIGH FREQUENCY VIBRATION TESTS prove stability of Aeronca structures to sustained G loads.

Expansion of our capabilities has created openings for additional senior engineers. Write to Mr. J. C. Maki, Chief Engineer.

#### TYPICAL SPECIFICATIONS FOR AERONCA STRUCTURES

- Continuous Temperature: 1000-14° F.
- Acoustic Shock: 160 decibels.
- Vibration: 15 G's at 2000 cycles/sec.
- Extreme resistance to corrosion.

New concepts in our designs are direct... built stressed and monolithic... generate critical stress factors that exceed the limitations of conventional structures. New concepts in structures, therefore, are a fundamental need to advance air weapons technology.

Stainless steel bonded honeycomb structures produced by Aeronca are meeting many of the "unsolvable" specifications inherent in High Mach performance. This is no mere coincidence. Aeronca has pioneered in developing high-temperature honeycomb fabrication. As a result, we are one of very few companies capable of producing these specialized structures in quantity.

Write today for details. Formal Aeronca inquiries will receive immediate reaction.



aeronca manufacturing corporation  
Generations Road • Middletown, Ohio

## SHORTLINES

► **Boeing, Air Lines of Spain**, report that it will conduct a "Spring Pilgrimage" for adults in Europe, and will set in contact with Air France and connect certain. The pilgrimage will leave New York on May 28, return on June 25. Cost is \$3,965. Directors of the pilgrimage is Father Sebastian, O.S.M. Cap. director of the Adult Education Department of the Catholic University of America in Washington, D. C.

► **North American Van Lines** has been approved by Intercontinental Air Transport Association for membership. The company is a major U.S. domestic mover, now now be appointed cargo sales agent by each of its members. In this capacity, the company will inform a customer's shipment to a point of destination. North American, which handled more 200,000 lb. of household goods to Europe during July and August, has agency agreements with Seaboard & Western Airlines, Pan American World Airways, American South American and United Air Lines.

► **Northwest Airlines** report that Viking Western flight from New York to Seattle raised a maximum load of 44 passengers. When the full fleet of Vikings is delivered by Dec. 1, the airline expects to have 1,000 seats a day in high frequency service between Boston, New York and Washington.

► **Northwest Airlines** reports on August opening revenue figure of over \$10 million, highest in the airline's history. August net operating expense of \$1,002,178, the airline expects a net income for the month of \$1,119,942.

► **San Francisco International Airport** reports August, 1955, airline arrivals and departures of 11,429, a 19% increase over August, 1954.

► **Seaboard & Western Airlines** have selected an English traffic for August, 1955, 1,113,000 net miles for a 42.5% increase over August, 1954.

► **United Air Lines** is offering, for the second season, ticket reservations services for those groups of 11 of the 12 National Football League clubs. Coupons for reserved box or grandstand seats may be purchased at any United ticket office and then exchanged for an advance ticket at the stadium's "old" office at game time. Football club members in the ticket service are Washington, San Francisco, Pittsburgh, Philadelphia, New York Giants, Los Angeles, Green Bay, Cleveland, Chicago, Cincinnati, Chicago (Barons) and Baltimore.

## AIRLINE OBSERVER

► **Witch for Sweden** announcement this week of the purchase of five Conquest 350 series Model 3125 jet transports, with an option for five more.

► **Cost Accounting Board** has turned down a second petition of the Air Transport Association asking that the domestic carrier be allowed to get together to discuss their domestic. The Board, however, was sharply split in the decision, with Chairman George H. Brown, Jr. favoring the petition and dissenting and Louis J. Hester filing a separate dissent. The Board, in its decision, did give the airlines permission to hold discussions on the merits of the petition to curb their accounts.

► **Domestic airlines** battle to stop the granting of U.S. route privileges to foreign flag carriers is being underscored by the eighth round of talks. Meetings held last week between the Dallas Chamber of Commerce and Air France and Lufthansa took latest step in U.S. cities to win a spot in global routes and the resumption of Houston's successful campaign to get direct European service via KLM. Dallas air market was dominated by French and German airline officials in Europe last week, by the Delta group and the possibility of getting the city as a new international route was explored. The move is expected to strengthen the French position in the transatlantic situation.

► **Pan American World Airways** inauguration of Boeing 707 jet transport service this month will come as a surprise to the airlines. Russia enters. Soviet newspapers and aviation publications have almost completely ignored the new U.S. jetliner and helicopter transports. Russian propaganda has been that "the Americans plan to introduce jet passenger service no earlier than 1955."

► **Broken close to the airline financial picture** about that they are poor results about future earnings. However, they take an optimistic look on the general financial picture for the airline. As our banker pointed out, operating cash flow has held up and, while not ready to say work down in the shareholders, it appears that the revenue will be there to serve bank and investor companies here for jet equipment.

► **British Airways** was the only domestic airline to report a load factor increase in each service during August over the same month of last year. And it was one of the only two airlines to cut back neither than domestic routes available nor sales during the month. Only two major American and Trans World Airlines reported a first-time load factor increase in August. They were two of six airlines to decrease load factor available seat miles.

► **United Arab Republic** aviation officials are expressing excitement about the Pan Am jet transport service from Cairo to New York. United Arab Republic. During a recent Moscow visit where he signed an agreement for direct USSR-UNAR airline service, Egyptian Air Marshal M. Sadi Maki noted that the "1949 excellent performance" has placed it in the best in the world among its competitors. United Arab Republic is expected to make a new sales appeal of the T-104's operating characteristics after Aeroflot, the Soviet-owned airline, began Moscow-Cairo service later this month.

► **Witch for a bid by the Spanish government** for an expansion of Iberia Air Lines routes in the U.S. after it completes its development program which includes two Douglas DC-6's scheduled for delivery in 1956. To strengthen its position in bilateral talks, Spain will advise Pan American's route through Madrid until then as a beginning tool.

► **Trans-Texas Airways**, in a move to combat its biggest competitor—the jet service—will offer first-class service for one day to passengers using TTA's service. Fort Worth, which is directed to non-stop, has been successful in developing new traffic on the airline's routes which are served with an average stage length of only 79 mi.



# The BEST WAY is by TWA



Dave Chasen, noted Beverly Hills restaurateur, approves a great airline.

## Sirloin of beef...broiled to your order in flight!

Your Ambassador flight hums toward the evening sun. Dinner is served—a celebrated event on TWA. You begin with cocktails, you conclude with coffee, a choice of liqueurs, and a satisfied sigh. But the high point, an airline innovation by TWA chefs and Dave Chasen, is a culinary masterpiece—a tender cut of prime sirloin of beef broiled in flight to individual taste. All this, of course, part of a most pleasant and rewarding trip by TWA Ambassador.

FLY THE FINEST...FLY **TWA** TRANS WORLD AIRLINES

# Airlines Face Tough Test in Market

By William H. Gargus

New York—Brokers are showing increased interest in airline stocks as an investment approach, but the enthusiasm of the financial community and aviation itself appears to be far short of that necessary if the airlines are to attract the capital flow accord on speculation.

Several investment firms have brought out carefully footed analyses and others have made simple "buy" recommendations on airlines as a group or individually. But when questioned, brokers will admit there are not many profit details and that there is considerable risk in the long public.

Unless investors be notably ungrateful, they will not see the airlines will be hard to increase north or south, but will be unable to rise rapidly at all should they go into the public market later on for debt or equity funds.

Airlines so far have been fairly successful in avoiding this step, but most investment houses around equity financing on a large scale will be nervous to get equipment. John H. Lewis & Co., for example, feels United Air Lines may sell well two million since common shares over the past five years to bring its total capitalization to \$2,555,000 shares.

Airlines thus are facing a critical test for future financing. Investors are more of the coming potential contained in the stock is not. But the airlines must face the potential into equity or debt, a psychological reaction by investors that can tend to stagnate an industry as well even though control remains in the hands of the public.

The attitude of the financial community could be summed up as a more best after life, provided "The Thin, Flaky of Wall Street."

•Probably the best informed analysis comes from the financial community, but some public opinion, however, not always all show long term outlook. Although these effects are exceptional, more than figures per se are required in investment portfolios by investors. The last information is too frequent to be ignored.

•Fundamentally, the best informed buyers are at least understanding purchase of airline stocks and are even buying on their own accounts. Some have a negative attitude that the cost has not as bad things were equal to get better. Others are hopeful potential in the airlines enter a new era.

•End result of these two factors produces a situation that can despite some severe problems airlines are getting the benefit of the doubt. But there is much variance of opinion.

One reason for this apparent confusion is that airline stocks showed better loss last November—a level where declines have been before and reversed. The standard used is that year is a percentage of book value, with the low point at 50%. One market analysis points out this measurement is not where earnings are not constant and the outlook is uncertain.

In stock exchange guidance, prices have moved a record and are on the way back up. While analysts recognize that airline stocks were probably not undervalued statistically at their low levels, they feel they are likely to follow at least a cracked pattern which will give them a package of assets covered higher value.

Prices indeed have followed such a

trend this summer, initially at least propelled by the extreme tax increase. Even though analysts may be well aware of the market decline, the investment houses report take full note of the response of the market that today, in general, is showing considerable rise to attract new the good times expected tomorrow.

In pointing out the drawbacks to investment in airline investment, one note these problems must frequently.

•Airlines have been a growth industry but not a net industry. A study by E. F. Hutton & Co. points out "Little of the transaction revenue growth of past year has found its way down to shareholders in the form of earnings and dividends."

•Increasing costs. There is no such thing as a free lunch, and it is likely to be reversed.

•Management doubts. Management did not get common criticism, but the point was made in some instances. One

## Domestic Revenues vs. Net Income

	Total Revenues (\$ millions)	Net Income (\$ millions)	Net as % of Revenues
1987	\$1,479	\$27	1.8%
1986	1,285	58	4.6
1985	1,135	67	5.9
1984	975	11	1.2
1983	879	42	4.8
1982	765	34	7.0
1981	686	49	6.9
1980	724	31	3.9
1979	660	19	2.8
1978	613	—1	—
1977	552	—20	—

## Cash Operating Profit Margin\*

	1989	1991	Change
American	12.8%	26.9%	+14.1%
Boeing	17.0	14.2	+ 2.8
Capital	11.1	15.5	+ 4.4
Cathay	16.4	14.6	+ 1.8
Delta	20.3	25.2	+ 4.9
Eastern	15.0	29.2	+14.2
Norfolk	21.3	24.6	+ 3.3
Norfolk	17.2	15.1	-2.1
Norfolk	12.1	19.8	+ 7.7
Trans World	5.2	21.8	+16.6
United	19.0	21.8	+ 2.8
Western	18.1	21.7	+ 3.6

\*Profit as operating profit, before depreciation expense, as % of operating revenues

\*From ending June 30.



WATERBURY'S special design (Type C) Airborne compressor is the first designed direct-coupled of large special motors. It has three special air inlet blades & Company's special compressor package (2 1/2 in. 3500 psi) used for auxiliary compressor power on jet engines.

## AIRBORNE CAN HELP YOU WITH LARGE SPECIAL-DESIGN MOTORS

Airborne can design and develop almost any type of large special motor you need and repair it in any quantity you require. Evidence of this capability is found not only in current projects, but also in the many different motors developed over the years for use on jet and prop. engines and electrohydraulic systems.

Typical of the large special motors designed and produced by Airborne is the one shown developed by Waterbury & Company to power one of its outstanding light-weight compressor pack-

ages. Special features include magnesium casings for weight savings, modified high-temperature stainless steel turbine and a special direct-coupled compressor (Type C) produced to pressure vacuum design at temperatures above 350°F.

Whatever your particular requirements in large special design motors, it will pay you to consult Airborne. Chances are we can solve your problem in good time and at reasonable cost. Write, phone or visit for more information.



Here courtesy Waterbury & Company, Inc.

### GENERAL ENGINEERING DATA

- Airborne Standard Design Motor S4-440-1**
1. 115/1000 v-c 480 cycle 3 phase (conforming to MIL-8116104)
  2. Mount 1. 7 pin 10-620 pin-10 in. h. full-inlet torque 28 in. lb. starting torque
  3. Duty cycle: 30 min. max. at full load 100 in. lb.
  4. Ambient temperature -40 to +125°F
  5. Accuracy: 1 to 30,000 ft.
  6. Weight: 9 lbs.



ROTOLON

NEW CATALOG

Describes Airborne's entire product line in a handy catalog.

See us at the Aircraft Electrical Supply Show in Los Angeles

LINEATOR® • ROTORAD® • TRIM TRIG® • ROTORETTE® • ANGLES®



AIRBORNE ACCESSORIES CORPORATION

HILLBIE B. NEW JERSEY

Represented in Canada by: WINNETT BOYD LIMITED • 745 Mt. Pleasant Rd. • Toronto 16, Ont.

## Airline Earnings Estimates

Airline	1972 Earnings per Share	Effect of Price Increases per Share	Effect of 1972 Capitalization	Estimated Future Earnings per Share (on month plus long term stable as last)		Rate of Return Based on 10% of 1972 Gross Revenue	
				Rate of Return		Earnings (per month)	Per Share
American	\$1.00	\$0.11	0.2%	\$0.40	\$0.11	\$10,555	\$0.59
Boeing	50	50	0.5%	1.00	0.10	1,000	0.10
Capital	-0.50	0.50	(N/A)	0.10	0.10	1,000	0.10
Continental	10	0.50	0.2%	0.10	0.10	1,000	0.10
Delta	50	0.10	0.1%	0.10	0.10	1,000	0.10
Eastern	0.10	0.10	0.2%	0.10	0.10	1,000	0.10
Eastern	0.10	0.10	0.2%	0.10	0.10	1,000	0.10
Northwest	0.10	0.10	0.2%	0.10	0.10	1,000	0.10
Rockwell	0.10	0.10	0.2%	0.10	0.10	1,000	0.10
Southwest	0.10	0.10	0.2%	0.10	0.10	1,000	0.10
Trans World	0.10	0.10	0.2%	0.10	0.10	1,000	0.10
United	0.10	0.10	0.2%	0.10	0.10	1,000	0.10
Western	0.10	0.10	0.2%	0.10	0.10	1,000	0.10

This table based largely on data in Unit E. Public Co. study, is an effort to reflect the effect of various factors on airline earnings. The figures are theoretical approximations and should not be used directly. Figures are based on latest annual reports of airlines. Future earnings estimates are based on capital structure at the end of the last fiscal year plus new and equipment commitments assuming 40% rate of return at 3% and 20% equity with additional stock sold at 10-12 average price.

better understood rather than management for failing to consider rising costs. An analyst commented that the airlines being a regulated industry, had been slow in finding funds in Congress. In fact, he said, that have shown signs of rejecting the realities of the industry.

**Civil Aeronautics Board policies.** Finally, the financial community is critical of the Board, especially for what it feels may be excessive intervention in airline matters. One of the major complaints was from a banker who gave credit to the Board in other fields but called it "profoundly unhelpful and unresponsive in financial affairs."

**Financing problems for new equipment.** Present rules and a rising capital on an industry basis is put about satisfaction for current needs. The flight attendant points out, but some airlines are reluctant to invest in capital even now. Further, the report says, results value of public places look bleak in the future, yet the CAB estimates look back on the rate of new equipment for each year in estimated earnings for setting up to produce a performance rate of return on invested capital.

Since these same funds are not wanted to publicly regulated airlines, with government, the analyst explained what the managers mean is that they want a market due funds to an industry with the industry.

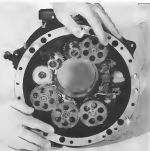
One point report made under this was contained a bill of particulars against the CAB that appears to reflect the general attitude of the financial community.

**Performance record.** In 1976-77, the Board awarded six airlines to 130 city pairs. As a result, profits in 1976-77 began to disappear.

New routes have forced purchase of new airplanes, new advertising campaigns, new ticket counters, new personnel and elaborate promotional schemes to lure passengers. Instead of maintaining traffic, the results have been a financial fall in load factors. Rather than strengthening the smaller carriers, the policies of the CAB the result has been to depress cost operating profit margins of virtually all lines, and especially of the three major domestic airlines—American, United, TWA and Eastern.

**Unrealistic accounting standards.**

# Specialized Gearing-Engineering Solved These Design Problems



Precision gearbox assembly designed and produced in quantity by Sundstrand Aviation.

## Complete facilities for precision gear and gearbox production

Where space, weight, and performance characteristics of gears and gearboxes are critical—on when designs are complex and difficult to manufacture—Sundstrand Aviation gearing engineering and production capabilities are of particular significance.

Highly stressed gear trains for aircraft constant speed drives, gear gearboxes, servoactuators and controls, two-speed gearboxes with governors... special bearings and pins are typical of the production at Sundstrand Aviation.

Facilities for gear generating and grinding, machining, tooling and jigging, heat treating, engineering, materials evaluation, testing and research are new, modern, and extensive.

Complete information is contained in a booklet, *Sundstrand Aviation, a Source for Quality Aircraft Gears and Gearboxes*. Send for your copy without obligation—use the convenient coupon.

SEND FOR DESCRIPTIVE BROCKET



Sundstrand Division, Denver, Colorado • Western District Office, Anaheim, California

Integral bearing centers, as illustrated at Sundstrand, increase gearbox engineering accuracy while greatly reducing the time and expense by eliminating bulk of a standard bearing.



Housing rigidity and strength maintained while achieving weight reduction in the Sundstrand gearing engineering design.



600° F silicon cast 5107 F aluminum is substituted for high compressive strength materials, such as steel, in the design of Sundstrand's integral environmental tub.

Sundstrand Aviation  
3421 Newark Drive, Rockford, Illinois  
Please send booklet on your gearing facilities and capabilities.  
Name \_\_\_\_\_  
Title \_\_\_\_\_  
Company \_\_\_\_\_  
Street Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_  
☐ Immediate Interest ☐ Reference

based in the Civil Aeronautics Board.  
Lower depreciation schedules have reduced aircraft operating profits.  
Full extent of nonoperating expenses controlled by reclassification of aircraft operating rates.

Current rates (current costs) to our view inhibit a good balance sheet rate of return for financial contributors and working capital written up by CAB specifying that certain fixed assets be included in operating costs.

Noncontingent the regulatory situation the report states, the industry has "all the disadvantages of a closely regulated public utility without the advantages of monopoly or substantial guaranteed return on capital and having all the positive problems of intensely cutthroat competition without the opportunity to make substantial profits for solving operational problems."

This report strongly criticizes airline management not for failing to help in cutting costs but for blundering along for the airline competition. It has Management reduce or new route awards. The study points out that even to take a percent profit in the market out applications that have a before CAB for all more realistic results.

It gives credit to both CAB and management for solving these problems with considerable economy—problems, however, such helped to create.

This recent Cigarette Report (CVR) Aug. 11, p. 28) detailing the financial problems of the industry is regarded as Wall Street as a management of duplicate in that—its close relationship with the CAB and to Congress that the CAB noted with the Civil Aeronautics Board yet another look at our cost centers of the Board.

Probably one of the most serious cost of this report is being interpreted as a sign of more to come government with our two of the carriers.

## Fast Increase Foreseen

Wall Street analysts is betting on a fast increase perhaps another increase in the future. The CAB notes that the immediate benefit from reduction of jet acquisition. At the E. F. Hutton study this month. Whether the wanted economies of jet operation in the forthcoming period will offset the increased use of money and purchased materials is questionable in the light of past experience with equipment and airlines. But the immediate prospect is for fast increases that will not have effect the extraordinary gains in costs.

Another study, from Humphreys, Naves & Co. explains its attitude in forcing airline stocks that "it should be stated that airline stocks are not

to be sold for values and explains, but they should show very real appreciation over a period of time.

Reasons advanced for this belief is various reasons.

- Large senior debt outstanding and characteristic low operating profit margin cost extreme leverage in these stocks. That is small change in profit margin can have profound effect on per share earnings, a key factor in the market's estimate of the worth of a stock.

- Belief that the industry is here to stay, that it is essential to the domestic economy and defense effort, coupled with the potential safeguard of a return to subject to extent of financial emergency.

- Long term benefit to economies and trade, resulting from jet equipment, though not discounting the short term problems involved.

- Resumed growth in the industry, though with increased sensitivity to reduced industry such as the current recession. Confidence remains that the airlines have yet to realize their full market potential.

Forecast of future earnings present a somewhat contradictory picture. While on one hand the investment man is just stuck on the value of line revenues on the other they point out that once increased taxes are not

**Bendix**  
**\* PYGMY**  
MINIATURE  
ELECTRICAL CONNECTORS  
Accommodate 3 times as many circuits as comparable AN arrangements

- 8-Way Pinpoint on PT Series
- All Housing Elements
- Lightweight, Compact
- Rugged in One-Block Shells
- Resilient Insert
- Closed Body Design
- Machine resistant
- Vibration resistant
- Heavy Duty Shielded Connectors
- Quick Element, Silver Solder

**SCINTILLA DIVISION of Bendix**  
Bendix Sales and Service, Bendix International Company, 4000 West 14th St., New York, N.Y. 10019  
Canadian Office: Bendix Electric, 2400 University Ave., Toronto 16, Ontario

**PG SERIES**  
Pinpoint Plug Terminals

**PT SERIES**  
8-Point Plug Terminals

**FOUR WIRE TERMINATIONS**

1/8" Diameter  
1/4" Diameter  
3/8" Diameter  
1/2" Diameter

**SERVING THE NATION'S INTEREST FIRST** **Autonetics** 

Security • Confidentiality • A Dependable Force Against Adversity



Autonetics is a leading provider of defense and security solutions, serving the nation's interests first. Our expertise in security, confidentiality, and defense against adversity is unparalleled. We are a dependable force against adversity, providing the most advanced and reliable defense systems available.

## Autonetics

Source: Calhoun, W. & Thompson, H. *Amazonian Indians*. 1936.

Also, it is generally posited over the long term that the arboreal insect actually sustains a reduced rate of return to investment. The question of whether growth increased from eight inches traffic seems to be ignored unless there is a tacit understanding of return to return, would, in fact, provide the higher return.

This provides some interesting comparisons. As compared to the Boston report, American Airlines earned a 9.2% rate of return in 1957 on its net worth, plus long term debt. Per-share earnings for the same year were \$1.08. Its balance sheet structure at the end of 1957 and selling price compared favorably with (assuming 41% debt, a 4.2% interest rate, and 51% equity with added stock sold at 1953 57 average price) the Boston report presents earnings per share of \$1.62 on an 8.0% rate of return base and \$3.31 at a 12% return.

### AMC Contracts

**Lurie Engineering Co** (Wholesaler) Lurie Steel and Trading Corp., New York, sells machine tools from MB-SA InventaCO, Milan, Greater Italy. (212) 708-94, mondays thru fridays regular office hours; Lurie's also serves other countries' distributors. (212) 756-6X-5000 and (212) 756-7341.

[illegible][illegible]

Southwestern Division, Radio Corporation of America, Bensenville, N. I. provides refinement of our (4) types of sound modules for dynamic transmitters and modules for mobile vehicles for industries. Phone: 10-11246 ext. 1771, 78-8 MM2 12541 5-89 1949.

The Edward F. Taylor Co. designs, develops, erects, and maintains an individualized space program, and also for private and public schools, colleges, and universities.

**Bullseye Value Products, Inc.**

Wedge Grip Range  
Fastener Made Full  
High Clinch  
Unusually High Pin Retention  
Positive Inspection  
A306 Stainless Steel

from 100,000 psi  
at room temperature

to 85,000 psi at 800° F.

Data on the strength capabilities of the "900" rivet is available from Townsend Company, Cherry River Division, P.O. Box 2257-N, Santa Ana, California.

1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840. 84

© 2008 Blackwell Publishing Ltd *Journal of Internal Medicine* 263: 101–109

**In Canada:** Permacor & Bulfinch Manufacturing Company, Limited, Canasque, Ontario

# DETECTION



**LMEE'S** airborne **GENDARME**™ will illuminate the unknown.



One or many, at clouds or clutter... nothing will elude GENDARME, LMEE's new "Airborne Early Warning and Control radar. New AMT (Airborne Moving Target) tracking and Pulse Compression techniques sharply aerial sea clutter, improve target definition. New "baiter" flight finding provides a truly 3-D search system. New data processing methods assure completely automatic operation. For further news on LMEE's detection developments write for brochure "Airborne Detection" or Search of Time, Dept. 77.

**GENERAL ELECTRIC**

LIGHT MILITARY ELECTRONIC EQUIPMENT DEPARTMENT  
FRENCH ROADS, YFICA, NEW YORK

**General Electric Co.,** Dept. 77, 1000  
North American Avenue, St. Louis,  
Mo. 63101. (314) 251-1000. (314) 251-1000.  
In Mo. (314) 251-1000. In other areas  
(314) 251-1000. In other areas (314) 251-1000.  
In other areas (314) 251-1000. In other areas (314) 251-1000.

**General Electric Co.,** Dept. 77, 1000  
North American Avenue, St. Louis,  
Mo. 63101. (314) 251-1000. (314) 251-1000.  
In Mo. (314) 251-1000. In other areas  
(314) 251-1000. In other areas (314) 251-1000.

**General Electric Co.,** Dept. 77, 1000  
North American Avenue, St. Louis,  
Mo. 63101. (314) 251-1000. (314) 251-1000.  
In Mo. (314) 251-1000. In other areas  
(314) 251-1000. In other areas (314) 251-1000.

**General Electric Co.,** Dept. 77, 1000  
North American Avenue, St. Louis,  
Mo. 63101. (314) 251-1000. (314) 251-1000.  
In Mo. (314) 251-1000. In other areas  
(314) 251-1000. In other areas (314) 251-1000.

**General Electric Co.,** Dept. 77, 1000  
North American Avenue, St. Louis,  
Mo. 63101. (314) 251-1000. (314) 251-1000.  
In Mo. (314) 251-1000. In other areas  
(314) 251-1000. In other areas (314) 251-1000.

**General Electric Co.,** Dept. 77, 1000  
North American Avenue, St. Louis,  
Mo. 63101. (314) 251-1000. (314) 251-1000.  
In Mo. (314) 251-1000. In other areas  
(314) 251-1000. In other areas (314) 251-1000.

**General Electric Co.,** Dept. 77, 1000  
North American Avenue, St. Louis,  
Mo. 63101. (314) 251-1000. (314) 251-1000.  
In Mo. (314) 251-1000. In other areas  
(314) 251-1000. In other areas (314) 251-1000.

**General Electric Co.,** Dept. 77, 1000  
North American Avenue, St. Louis,  
Mo. 63101. (314) 251-1000. (314) 251-1000.  
In Mo. (314) 251-1000. In other areas  
(314) 251-1000. In other areas (314) 251-1000.

**General Electric Co.,** Dept. 77, 1000  
North American Avenue, St. Louis,  
Mo. 63101. (314) 251-1000. (314) 251-1000.  
In Mo. (314) 251-1000. In other areas  
(314) 251-1000. In other areas (314) 251-1000.

**General Electric Co.,** Dept. 77, 1000  
North American Avenue, St. Louis,  
Mo. 63101. (314) 251-1000. (314) 251-1000.  
In Mo. (314) 251-1000. In other areas  
(314) 251-1000. In other areas (314) 251-1000.

**General Electric Co.,** Dept. 77, 1000  
North American Avenue, St. Louis,  
Mo. 63101. (314) 251-1000. (314) 251-1000.  
In Mo. (314) 251-1000. In other areas  
(314) 251-1000. In other areas (314) 251-1000.

## SENSATIONAL NEW FLEXIBILITY

### ONE MODEL THREE MODES

✓ DIFFERENTIAL ✓ ISOLATED ✓ GROUNDED



EXTREMELY LOW DRIFT  
WIDEBAND DC AMPLIFIER

Write for Bulletin AT 1201

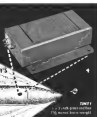
COMPUTER ENGINEERING ASSOCIATES INC.

UNCLASSIFIED POWER SUPPLIES • DIRECT ANALOG COMPUTERS • ENGINEERING ANALYSIS

**TOUGH**  
and tiny

Save SPACE  
and WEIGHT with  
The A. W. HAYDON COMPANY'S  
Unique Use of

RELIABLE SUB-MINIATURE  
TIME DELAY RELAYS

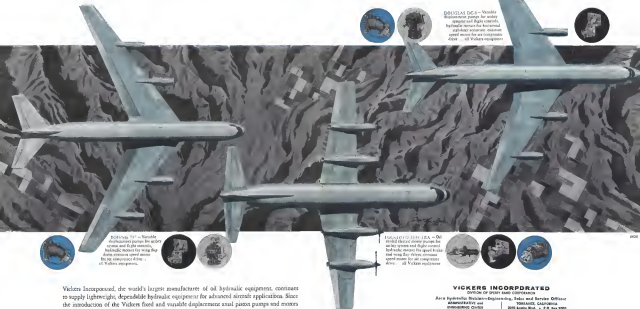


TEMPERATURE: -55°C to 125°C  
Moisture: 95% RH  
Shock: 100 G's  
Vibration: 10 G's  
Circuitry: 100% Gold Wire  
Construction: 100% Gold Wire  
Testing: 100% Gold Wire

**A. W. HAYDON COMPANY**  
100 YEARS OF RELIABLE ELECTRONIC EQUIPMENT  
Design and Manufacture of State-of-the-Art Timing Relays

# VICKERS CONTINUING LEADERSHIP

*America's new turbine-powered transports use Vickers hydraulic equipment*



**DOUGLAS DC-8**—Variable displacement pumps for water systems and flight controls, hydraulic servos for horizontal stabilizer, automatic direction speed servos for air conditioning fans—all Vickers equipment



**BOEING 747**—Variable displacement pumps for water systems and flight controls, hydraulic motors for wing flap drive, automatic speed servos for air conditioning fans—all Vickers equipment



**LOCKHEED L-1011-124**—Oil cooled thrust reverser pumps for water systems and flight controls, hydraulic motors for gear brake and wing flap drive, automatic speed servos for air conditioning fans—all Vickers equipment



Vickers Incorporated, the world's largest manufacturer of oil hydraulic equipment, continues to supply lightweight, dependable hydraulic equipment for advanced aircraft application. Since the introduction of the Vickers fixed and variable displacement axial piston pumps and motors for aircraft use in 1940, marking the beginning of the modern era in aircraft hydraulic system design, Vickers has continuously advanced the "state of the art". This extensive experience is reflected in the reliability of Vickers equipment which is installed on virtually every current U.S. military and commercial airplane as well as several aircraft registered in more than forty countries.

For further information, write for Brochure A-5280-ES.

## VICKERS INCORPORATED

Division of Dresser Industries, Inc.

Basic Hydraulic Division—Engineering, Sales and Service Offices

Administrative and

Engineering Offices

Department 1902 • Route 90 • 9001

Area Hydraulic Division District Sales and Service Offices

Albuquerque, Long Beach, St. Louis, 1900 Wilshire Ave. • Arlington, Texas • 1900 Wilshire Ave.

Boston, S. Washington, 1515 Ave. South • Washington, D.C. • 1900 Wilshire Ave.

Additional Service Offices at Miami Springs, Florida, 1411 So. Bay Drive

TELEPHONE 900-1902 • 1900 Wilshire • 1900 Wilshire • 1900 Wilshire • 1900 Wilshire

TELETYPE 900-1902 • 1900 Wilshire • 1900 Wilshire • 1900 Wilshire • 1900 Wilshire

The Dresser Hydraulic Co., Ltd. • 1900 Wilshire • 1900 Wilshire • 1900 Wilshire • 1900 Wilshire



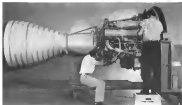
**THREAT** chamber tubes are stacked on a truck until pig is welded portion (left) and are held in place by an ordinary bicycle tire inner-tube. Tubes are tramped corners for smooth fit. At right, tubes are bound with silver solder and heads are welded.

## Flexibility Helps Build IRBM Engines

By Cong Lewis



**THOR** engine is in current stage of assembly at Rocketdyne's Natick plant production line. Chambers attached engine get final adjustments at final line position (below).



Natick, Mo.—Liquid fuel rocket engines for Thor and Jupiter intermediate range ballistic missiles are produced here by Rocketdyne Division of North American Aviation, Inc., in a flexible production operation geared to take advantage of the latest requirements in engine development.

Rocketdyne currently is delivering a line model Thor engine which incorporates recent refinements dictated by field experience. The Jupiter engine, which differs from the Thor power plant only in detail, currently is being phased into production at the Natick plant.

### Ordered Into Production

The Thor missile and its powerplant were ordered into production by the Air Force long before either was present in flight test. This meant the production operation would have to be flexible enough to cope with the inevitable engine variants developed in testing progress. Test programs and field experience will decide some engine modifications and further research will develop others.

Rocketdyne, for example, is working on a simplification program aimed at replacing the Thor engine's present 60 components with 15. All such changes must be incorporated in the production line.

Natick production finally started in June 1956 with the award of a contract which, the Thor engine was still under development by Rocketdyne's Canoga Park plant. First engine was completed at Natick in July 1957 and since then it has moved into regular

## MISSILE ENGINEERING



**COMPLETION** third chamber is assembled on tubes for assembling operation after completion of boring and welding.



**ENGINE** is tested at Natick rocket engine test stand. Doors in external case will be opened during design for visual engine checks.

Do you know about  
Gask-O-Seals?

## THIS Gask-O-Seal EXCEEDS HERMETIC SPECS!

Gask-O-Seals often exceed or exceed specifications for hermetic sealing. The seal shown here has pressure from eight sealing gases and a vacuum of one hundred atmospheres. The leakage rate is less than the standard. Examples are specified on request for which no charge is levied. We say that on facts.

Gask-O-Seals are high and low pressure seals which require NO gummy machining in manufacturing. A flat surface with only a 125 RMS surface finish is all you have to give us to get your seal working with a Gask-O-Seal.

There are many other outstanding features about Gask-O-Seals. Contact us for full details, up to ten of standard design types may be made and replace the factory built up product in one day. Why not find out about Gask-O-Seals and the other units of Parker Seal Company's Gask-O-Seal Family today. The makers of Parker O-Rings.



**Parker**  
**SEAL COMPANY**  
CULVER CITY, CALIF. • CLEVELAND 13 OHIO  
A DIVISION OF **Parker Hannifin CORPORATION**

Circle 11 on Reader Service Card



**TIG WELD** (center) is a steel liner which is held in place by vacuum. After heating and welding operation, the jig holder device for easy removal from the completed chamber.

production. This plant has developed directly in a production facility, and Rockwell's growth and development work is still done in Culver City.

The engines are produced in a 200,000 sq ft facility operated by Rocket-Dyn for the Air Force. Along with the plant, the company has a 100-acre leased security area for production testing, and 1,155 employees are at work fabricating and testing the rocket powerplants.

Manufacturing one of the Nozzle plant is a standard layout adaptable to any kind of metal manufacturing. Plant Manager J. P. McNamara points out that the line, before it is built, and can be changed to adapt to production line modifications or changes in production rates. It is also adaptable to production of new engines which may be developed in the future.

Most of the production job is done

in an open factory area, although a heated amount of machining and source life is done in an conditioned environment. That control will probably be added in the turbo pump assembly area.

Production cycle on the Thor engine begins with fabrication of its thrust chamber. The chamber employs a tubular construction which gives it the benefit of light weight with significant cooling capabilities. The engine's RP-1 fuel first up and down through nearly 100 tubes which circle up the chamber wall before it passes into the injector and is combined with liquid oxygen under the chamber. This cooling helps the thrust chamber withstand the temperatures of more than 5,000°F which occur during burning and it offers a slight gain in thrust by preheating the fuel.

The tubular construction replaces



**THOR ENGINES** are shipped in mobile trailer containers which are transported on high-speed trucks. Containers also can be lifted in a Douglas C-124 Globemaster transport.

AVIATION WEEK, October 6, 1958



## Where dependability is vital RELIABILITY TESTING is a must!

The proper functioning of complex systems such as computers and control systems depend on **HIGH RELIABILITY**. Actual stress on complex systems is proven through specific testing techniques: random testing, component performance data, reliability prediction and failure analysis. Included in our capabilities are American aerospace automatically programmed test chambers, each capable of handling tens of thousands of components with automated parameter control necessary long-term monitoring. These are the most extensive computerized testing laboratories available to industry.

### INLAND TESTING LABORATORIES

4000 GARDEN STREET, BOSTON, MASS. 02130  
1400 SHAWMUT AVENUE, EASTON, MASS. 01025

**NEW**  
**"PRE-TOOLED**  
**FILLER CAP"**  
**GUIDE**



## simplifies design-procurement!

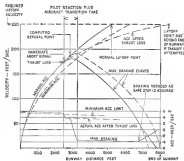
It's the key to a wide range of pre-tooled filler caps and components. Highly adaptable to aircraft, missile, ordnance and other activity fueling systems. Many combinations direct from stock. Why duplicate? Write for your guide today!

## SPECO

(Dural Products Engineering Co.)  
DIVISION OF ROBERT-HAYES COMPANY  
SPRINGFIELD, MASS.



# Now, a Honeywell Takeoff Monitor warns pilots in time to stop!



Developing air speed for takeoff depends on proper acceleration. Honeywell's system uses acceleration as the control parameter for determining aircraft performance during takeoff. Acceleration loss measurement indicates deteriorated performance.

Now, for the first time, a pilot can receive a positive, automatic signal which tells him if his takeoff is not progressing normally. The no-go signal is generated only if there is enough remaining runway to bring the aircraft to a safe stop. When it comes, the pilot is free to devote full attention to takeoff procedure.

In addition, the Honeywell Takeoff Monitor gives appropriate distance remaining to the critical point—takeoff

run which tells the pilot whether normal or maximum braking (which may damage the aircraft) is needed.

This new concept will prevent most takeoff accidents. It will result in decreased runway down time and maximum cost due to full-brake stops. For the complete story on the Honeywell Takeoff Monitor, write: Minneapolis-Honeywell Aero-Devices, Dept. AW 15-134, 2600 Ridgeway Road, Minneapolis 13, Minnesota.

## Honeywell

**H** Military Products Group



WELDS and bracing to thrust chamber are checked by X-ray for proper position.

the double wall type chamber first used in the German V-2 rocket motor. The basic approach was developed by North American for the Navaho booster and later applied to the Thor, Jupiter and Atlas engines. When the rocket was made in 1954, North American engineers found tubular construction cut the weight of a thrust chamber in half.

The thrust chamber starts out as a cylinder of straight, round metal tubes 0.45 in. in diameter. They are bent slightly and put in a tube press which changes them to a rectangular shape and gives them a slightly different thickness at each point along their length.

### Pressure Formed Tubes

When the tubes have been pressed, formed, inspected and depressed, nearly 100 of them are placed in a tank with oil which forms the internal shape of the thrust chamber. The tubes are inspected to make sure there is no more than a 0.005 in. gap between them, then they are held in place with steel bands which are in pairs and are one to six inches wide. The bands are spaced apart on the lower part of the chamber, but they form a solid pocket around the chamber throat where pressure is highest.

The tubes are bound with other solder, and the surrounding steel bands are welded. A collar welded around the neck of the chamber forms an attachment point for the guiding gear. It then goes to a gap tube and axial drill point to prepare it for installation of the injector plate.

At the same time, Rockaforte is building up other components, such as the double-ended turbo pump, which was developed for the Thor and Jupiter engines from initial work done on the Navaho project.

After the completed thrust chamber

add  
subtract  
or multiply  
two signals

...with CEC's computing galvanometer

Now all direct linear computations can be performed by our galvanometer — two signals can be added, subtracted, or multiplied and the results recorded as an oscillographic trace. Ideal for low-level power measurements in electronic equipment, the 7-370 computes instantaneous watts ( $P = EI \cos \phi$ ). Its phase sensitivity enables the user to determine power factor, and it can also be used to record rate and difference frequencies. Built-in compensates features of a circular body housing the moving coil and mirror, with two outside bodies housing battery field coils and a static reference mirror for exciting zero. The 7-370 is compatible with any standard CEC Recording Oscillograph. For full literature call your nearest CEC sales and service office, or write to Bulletin CEC 1465-N.

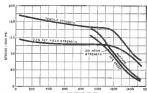
Transducer Division

**Consolidated  
Electrodynamics**

302 North Zeeb Avenue 1916 Anaheim, California

ACCELERATION LOADERS IN GALVANOMETERS • TRANSDUCER  
PRESSURE AND VIBRATION INSTRUMENTATION





Graph shows high tensile, creep and rupture strength Incoloy "901" provides at 1000-1400°F.

## New standard alloy... "super" alloy properties!

In the 1000-1400°F range, Incoloy "901" non-radiant-chromium alloy has properties which match those of "super" alloys.

Its nominal composition is 40% nickel, 13% chromium, 2.60% titanium, 6.00% molybdenum. The balance iron.

Incoloy "901" alloy was especially developed for rocket and gas turbine components. This alloy provides high tensile, creep and rupture strength (see graph), good oxidation resistance and favorable expansion characteristics at elevated temperatures.

### Solution treatment extends time-to-rupture

In bar stock, time-to-rupture for a given stress and temperature can be extended by a high temperature solution treatment before aging. Sheet is heat formed in the annealed condition and aged by a short time (2 hr) treatment at 1400°F.

### Other new high temperature alloys developed by Inco

In addition to Incoloy "901", Inco has developed four other high temperature alloys which deserve attention in missile design. They are Inconel "713 C" nickel-chromium alloy, Inconel "700" age-hardenable nickel-cobalt-chromium alloy and Inconel "702" aluminum-containing nickel-chromium alloy. For basic data on all five, write to the address below.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street



New York 5, N.Y.

**INCO NICKEL ALLOYS**  
NICKEL ALLOYS PERFORM BETTER LONGER



U.S. Air Force's Thor

low temperature and flow directed, gaseous bearings are installed and it is connected to the main propulsion package of turbo pump, gas generator, main line for fuel and liquid oxygen and other components. Now the engine is ready for test firing.

The nature of the rocket engine makes precision work and close quality control essential. Rockwell's keeps a close check on materials coming into the plant and on each step of the production job as the engine develops. Use of a precision control system which splits out main operations in detail helps ensure close tolerances and consistent manufacturing process.

Since the production process is kept as simple and flexible as possible, there is no great fear of automated machinery to be changed when modifications are placed into the line. But that doesn't mean the fabrication job is done without any automatic machinery.

Turbo pump casings are drilled with an Ex cell-O automatic that is specially designed to do a sequence of precision operations. The injector plate, with its requirements for close tolerances and accuracy, is another area where automatic machines are used extensively.

### Perforate Drilling

Rockwell uses a perforate drilling machine to drill and ream fuel inlet holes in the injector, which is made of 4130 steel. The machine drills 18 holes of varying sizes and depths. It was designed and built by Rockwell, with the drilling heads furnished by the Aero Corp.

After the fuel inlet holes are drilled, the injector moves to a Zagar machine which drills 716 holes in the injector in 30 sec.

This operation compares with an 8 hr. job of drilling the holes one by one with a manual drill press under the old method.

Then the injector goes to a Micro machine on which the outer is controlled by magnetic tape. This machine profiles the top and bottom face of the injector, making a series of four cuts and deep pocket cuts. Former method required 12 hr. to make a part, but the Micro, which is just going into service, cuts this time to 7 1/2 hr. and also cuts inspection time because inspection now has to check only the five points where the operator has control of the machine.

It is in the area of production testing that the Rockwell manufacturing process really began to vary widely from ordinary manufacturing jobs. The whole job ends in a series of engine firings which are spectacularly unlike other types of production testing.

Testing of the components and the engine goes on right from the beginning of the production line and much

INFRA-RED  
INFRA-RED  
INFRA-RED  
INFRA-RED



INFRA-RED

BAUSCH & LOMB OPTICAL CORP. • ROCHESTER 2, NEW YORK

Would you like to be kept informed on progress in infra-red as it occurs at engineering levels? This could be very useful in helping you evaluate developments that might well affect your own associated projects. That's the reason for progress reports we're sending out. Why not let us send them to you, also?

The reports will cover information on infra-red items that we feel can prove of value to you - how new calcium fluoride glass etching developments of transducer systems, how unique films set new standards of accuracy in analytical determination - and much, much more.

And there aren't just laboratory samples we're going to be talking about. Our infra-red components have been proved in current operational missiles and are being supplied in production volume.

We're doing a lot of interesting work with infra-red materials—draw research to performance-tested materials. Why not fill out the coupon. We're pretty sure we can tell you something that's worth knowing.

BAUSCH & LOMB OPTICAL CO.  
86724 St. Paul Street, Rochester 2, N.Y.

Please add my name to your distribution list of B&L Infra-Red Progress Reports

NAME

TITLE

COMPANY

ADDRESS

CITY  ZONE  STATE

BAUSCH & LOMB





## the NEW BELL Ranger



Skidoo, larger capacity fuel tanks for extended range.



Model 300, like better yet. Skidoo, longer life.



CAA approved Day-Glo paint 50% to complement new engine skidoo.

### top of the line for '59!

You know immediately... there's something new in the air... when you see the dash of color the '59 Bell makes in the sky. That's its new Day-Glo paint trim... for good looks, for high visibility... a CAA endorsed safety measure. New Horton and Horton designed interiors with the executive look bring you a choice of new fabrics and color combinations.

That's the look... but it's the built-in performance and maintenance features that reflect the value and integrity you get in the new Bell. For there are new metal blades, to improve performance, give longer life. There's the extended range from larger capacity fuel tanks that have been beautifully integrated into the streamlined cabin design.

And, there are such things as a new engine mount that extends the overhaul interval up to 2,500 hours... individual seat belts... a speaker and traveling radio... new maintenance and passenger access steps... a stainless steel exhaust shroud. All in all, over 25 new features and improvements made possible by Bell's many years experience in the field.

For Bell has more experience than any other helicopter manufacturer... over 2,500,000 hours of flight in 52 countries world-wide. And this new Bell incorporates, along with its new refinements, all the tried and true features that have made Bell the pre-eminent name in helicopters. It's why the '59 Bell brings you more for your money than ever before. And it's ready for delivery now! For more information about the exciting new Bell, write Department 223, Bell Helicopter Corporation, Fort Worth, Texas.

Extraordinary opportunities for highly creative engineers with extensive academic background... to solve the new and challenging field of helicopter research and design. Send resume.

**BELL**  
Helicopter Corporation

FORT WORTH, TEXAS • SUBSIDIARY OF BELL AIRCRAFT CORPORATION

of it is done with special equipment. When the thrust chamber has been mated and welded it is examined by X-ray. Then it is mated and tested with 70 lb. of pressure to find any leaks. So, says the robot. The robot themselves are tested under 1,000 lb. pressure in a duct to internal leaks.

In a cold flow test the tubes of the thrust chamber are flooded with more than 1,500 gals. of water to verify if internal fuel flow. Different flows through the chamber are checked for pressure drop to make sure the flow of fuel through the system will fall within specifications.

Engine pumps are calibrated with a 2,500 hp. electric motor pump driven with a high volume flow of water. Turbine pumps and gas generators are hot fired in the test stands before they go into the engine. The complete engine package goes through an electro-mechanical check, so its status before it leaves the plant.

After it comes off the production line, the engine is mated to a 20 ft. thrust alignment tower, and optical equipment is used to find its geometric center. Rocketdyne also uses the tower to find the moment of inertia, which is a set of numbers demonstrating that tells whether the gimballed nose of the engine is within certain limits and adoptable to the missile guidance system.

When it has completed the production phase, the engine is moved to the test area for firing. Also, Rocketdyne has two test stands, and each stand has two engine positions. Test area also has a separate complex of test stands for such components as gas generators and nozzle engines.

Test stands for the rocket engines have the usual plumbing and hardware: water-side tanks and gases detectors. The stands can lift up to four tons the thrust developed in ground engines. Cold weather prevents a facility problem because of water freezing in test stand systems, but Rocketdyne expects to solve the problem by completely draining the stands and using shore heat to maintain a temperature in the vicinity of 50 deg.

Each production engine is fired several hours. It is tested until it shows that it meets customer specifications and full power is applied on all runs.

When production testing is complete, the engine is shipped in a new metal container that is about half the weight of the conventional steel engine case.

Engines are loaded to three Air Logistics Model Trainers and loaded to the customer. Some of the Thor engines are loaded to Atlas and loaded, three at a time, into Douglas C-124s, and others are loaded to Callaghan for delivery to Douglas Aircraft Co.

## Aerodynamic scientists

NAA-Columbus has related openings in its Aerodynamic Science Section: New aircraft, missile, and research contracts have created excellent career opportunities for experienced engineers in:

**STABILITY and CONTROL:** Engineers and Sr. Engineers with several years comprehensive experience in stability and control, firing qualities, and zero loads determination required for analytical, wind tunnel and flight test development of low- and high-speed aircraft configurations, tactical and target machines for the Armed Forces.

**FLIGHT CONTROL SYSTEMS:** Senior Engineers for integration of flight control and stability augment systems with an optimum configuration development of high speed aircraft and missiles to obtain desired dynamic flying qualities. At least 2-5 years experience required in 5 and 6 degrees of freedom, dynamic stability analysis, servo analysis, feedback systems, prediction of aerodynamic stability derivatives and related development areas.

**AERO-THERMO RESEARCH:** Senior Engineers with M.S. degree and experience in Ph.D. degree to conduct basic and applied research in the following areas: supersonic and hypersonic flow, heat transfer, airfoil mechanics, magnetohydrodynamics, re-entry studies, nose cone design, development of design and prediction methods in these advanced areas.

Applicants with applicable degrees and related experience are invited to write to:

Engineering Personnel, Box AW 383  
North American Aviation, Inc.  
4380 East Fifth Avenue  
Columbus 26, Ohio

THE COLUMBUS DIVISION OF  
**NORTH AMERICAN AVIATION, INC.**



NAA-Columbus... home of the F102 Jet Trainer and the A-7F Vigilante.



**BOEING 707** jet transport, leaving Pan American World Airways hangar, takes off using water injection system (note dark smoke).

## Airline Week Pilot Report (Part I):

# Boeing 707 Is 'Honest' Airplane; Demands

By Richard Severey

Seattle-Airline pilots who will be flying Boeing 707-120 transports should find flight transition into this transport aircraft relatively easy.

But takeoff procedures, preflight and en route planning will require a much higher order of accuracy and thoroughness than pilots transports to stay ahead

of the many factors which are essential to efficient transport operations.

Pilots will find their new aircraft is honest. It has performance to spare when properly handled. Although it has the characteristics of a large, heavy winged aircraft, it has very good control in normal and critical flight regimes. Entering design area of the flight envelope is quite simple, requiring

no 45, even less backup safety devices in addition.

Flight characteristics were assessed by the American Warp evaluation pilot flying in the left seat of N707PA, in which the fauchant and reliability (F&R) phase of CAA certification flight test program was being conducted. Aircraft No. 3 Pan American plane, was completely airborne standard in cockpit,

# Planning Care

equipment and in its cabin interior.

The aircraft user has been told that, has been used in lifeline operations to Puerto Rico, and an immediate case to escape to check out aircraft and conduct crew training in well.

## Outstanding Features

Outstanding features of the production airplane which incorporates the latest in Boeing developments include:

- Landing gear legs, which make gear possible to climb into at low speeds, require little and landing distance.
- Production thrust reversers now in stalled and in use as well as stand up pressure.

- Vortex generation on vertical fin, and no gas full deflection and increased effectiveness at low speeds, instead of the hydraulic boost which was to have been incorporated (AW Jan 20, p. 49).

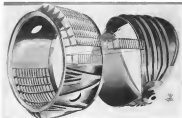
- Spoiler select switch, by which cut board or reduced sets of spoilers can be deactivated, moving the wing center of pressure fore or aft to compensate for a heavy horizontal stabilizer.

- Vortex generation on wing upper-surface, between inboard pods and fuselage, which smooths airflow and reduces drag at higher speeds, increasing critical Mach number to 0.1.

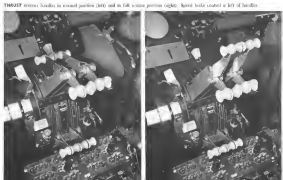
Equipment on N707PA included Boeing Electronic Primary PB 300 autopilot with approach coupler, variable drag Mach trim, plus Sperry Integrated Instrument System (IIS), consisting of a 3-in. attitude indicator with



**CASCADE** rear buckets for thrust reversal are located ahead of supersonic flow (top right). All 707s have both components.



**CASCADE** and cascade for thrust reverse for unit which is pulled out in a bucket (above). Aircraft can be controlled by wing differential moment power along side. Reverse mode (below) were tested in a 4 ft. x 8 ft. wind tunnel where air flow simulates two speeds of 60 mph. Stress in pod and model pods to make flow visible. Cascade rear arrangement permits air exhaust upstream into the engine.





## NEW...LIGHTER, STIFFER ALCOA ALLOY DEFIES 1,600-MPH SKIN TEMPERATURES

Alcoa's newly developed alloy X3000 withstands aluminum's stiffest previously held to speeds below 1,500 miles per hour because of destructive skin temperatures. This new 14000 alloy, a major breakthrough in metallurgical research, raises speed limits to 1,600 mph because it retains its physical properties up to 400° F—more than 100° F above present aluminum strength limits.

Compared to other aluminum alloys, X3000 is 3 per cent lighter. For use in structures subjected to air over-all resistance in aircraft weight. In its research and development work with Alcoa as an important alloying ingredient, Alcoa found the alloy's strength greatly increased resistance to heat deflection.

In addition to elasticity in 5 per cent greater than standard aluminum alloys. When compared only loaded aluminum are considered, X3000's high modulus and low density characteristics help reduce weight by 10 per cent.

In order to produce alloy X3000, Alcoa had to develop expensive new alloying and casting equipment and techniques. Even though the new alloy is costly, it provides superior resistance with the most economical solution to high-temperature problems. Titanium and high-strength steels would add to both the cost and weight of a structure.

Alcoa alloy X3000 leads itself to standard fabrication processes and is

now available in sheet and plate. Extrusions and forgings are available permanently. For more data information about new Alcoa alloy X3000, call your Alcoa sales engineer. He has up-to-date technical information and performance data.

Aluminum Company of America, 3500 J. Edgar Hoover Building, Pittsburgh 15, Pennsylvania.

For Circle 17, See In Aluminum News



ALCOA TRUSTEE  
Five Trustees  
Alcoa World  
Division

new  
horizons  
for  
dim  
light  
photography  
and television...



Super-Farron...an ultra high speed photographic objective having extremely fine correction over an unusually wide field. The advantages of its photographic speed of 1/100 for operation under adverse light conditions are evident.

It is available with standard velocity correction for dim light photography, and it can be supplied corrected for 16:1 or 4:1 compression for special purposes. The Super-Farron is eminently suitable as an objective for Image Orthon television cameras or for special 35mm photography.

Technical data available on request  
Specify Engineering Report No. 227

Aviation Week, October 8, 1955

profile projection, clockwise comparison and control a constant heading, both wings are in the line, surface is in the proper operation, with development aimed at more comprehensive use of the system in helicopter operations. Light plans are prepared with objectives calculated for the pilot's choice. In the future, on course changes due to weather the forecasts are as highly possible if not probable, and other factors of which operations, instrumented air bases, may be accounted for in flight plans and alternatives.

As speed, critical to better degree on all airplanes, is even more critical on large, rapid wing jet aircraft.

On the Boeing 707, speed must be maintained constantly. Involves can be controlled but at both ends of the spectrum while in the middle, speed and economy are closely related.

As a result, speed must be carefully close with on 707 altitude.

At altitude when airplane's nose is lifted for takeoff. Dragged V, the speed has been used in Boeing flight test work with a value of  $V_0$  minus 15 ft., where  $V_0$  is maximum lift-off speed. CAR has defined  $V_0$  with so-called limits at the moment, but again in Boeing flight test work, it has been assigned a value of 1.7  $V_0$ , where  $V_0$  is still speed. Critical capacity, so no go speed in  $V_0$ , while  $V_0$  is maximum

control speed. If pilot wants aircraft to maintain a constant speed, it should longer takeoff can required. Similarly, takeoff altitude must be known.

At engine out after V, and V have been passed in takeoff. Theoretical control is made maintained with full radar deflection applied immediately, then checked off as required. However, speed must be maintained to make good rate of climb, or so it is designated for such operations, climb gradient.

During some climb-out climb, which Boeing has established at the speed  $V_0$  plus 10 ft. If a plot is made with climb rate as ordinate against an altitude for speed and climb-out airplane, the longest curve starts at highest speed, slopes upward much more steeply. A 1-ft change in speed will have much more effect on a plot than one that is a parallel curve.

At top, situation, cost must be considered so that while airplane has come up altitude, speed is sufficient to maintain positive climb rate, does not drop in altitude rate despite altitude. But, considered in  $V_0$  plus at least 7 ft. 400 ft. altitude, before starting incremental reduction.

When initial climb altitude is reached. If engine is not reduced altitude, use quickly reach and pass in black limit.

At start of final approach. Constant

approach, at Boeing is to start the final approach with  $V_0$  plus 30 ft., which is 300 ft. above. In case of engine out, go-around, or both, without as speed is available for safety margin. As climb altitude can be dropped with full throttle with no effect of approach, as speed on approach from altitude.

### Visual Checks

When used by the aircraft is relatively simple. Includes visual inspection of lines in which walls, pressure and quantity gauges where applicable, proper position for engine surge limit values check, on time, position of track level check, and a check for foreign objects in vicinity.

Although cockpit instrumentation was ground to an extent by a period in the Boeing transition, more thorough instrumentation was obtained during flight riding, check pilot seat, especially with radio and gear position to the American's international operations.

Since "F" pattern of light status marks is specified by CAR, does not obtain in the American airplanes, which are operated on foreign routes. The RMI VOR/ADF (page of Sperry ES) occupies the left spot, with the attitude indicator to the right, speed to the left. At right of the attitude gauge is a large clock. Second row of instruments has altimeter, horizontal situation dis-

# SUPER FARRON F/0.87

76MM • 30° FIELD  
40MM FOCAL PLANE

FARRON OPTICAL CO., INC.

Engineering, Design and Production  
1000 Broadway, New York 10, N.Y.  
Phone: MU 2-1100 (3 lines, auto. conv.)

plus portion of IIS and into the thrust indicator. Bottom row of gauges are Mark number and turn indicators, giving an overall 6-12 arrangement.

The merged gyro has a new face with incremental outputs in the lower speed spectrum and high speed area. A rotating outer band has been added to the extreme face of the gauge which pilot can use to read for reference in climb.

Engine gauges are in the center panel for 1-2-3-4 powerplants, left to right. Across the top of the panel are amber threat engine operation warning lights which go on as soon as revolvers are sleth leave the fully fixed position.

First row of gauges are fuel engine pressure and rpm (EPR), a measure of all power and thrust. Second row contains engine gas temperature (EGT) gauges. Third row is hydrometer for fuel stage temperature (N<sub>2</sub>) (expressed in percent fourth row is fuel flow in pounds per hr. and bottom row is second stage compressor tachometer (N<sub>2</sub>). Down the left hand side of the center panel are a true speed indicator from pitot or air data station, outside air temperature, temperature from alignment gage, second indicator light, fuel switch, flight hand edge of the center panel has landing gear down and gear up warning lights, three green gear down lights, gear up

warning lights and a red master selector switch for pilot display.

Copilot's light instruments are duplicates of pilot's a dash left, 4-1-1 arrangement. The center has position indicators for selected and method flap on the left side of his panel, under these are takeoff water delivery pump switch and function lights, down valve monitoring switch. Along the bottom of the copilot's panel are operating switches for climb and descend, lo, draft, advance, pressure gauges warning lights and an atmosphere switch for ground test which holds hydraulic pressure together for test.

Center pedestal has a radar screen on that is center, ahead of operating levers, with navigation and other electronic gear operating panels on left and right. The pilot's side has controls for radar radar beacon transponder while the copilot's side has Select (Dual ADF) installation but one set of controls on each side.

Operating levers on the pedestal are low engine thrust levers with reverse operating handles an integral part. On the left of the thrust levers is spoiler control with setting and exposure the lever itself. To the right of thrust levers is the thrust control, for operating handle with switches for each 10 deg. travel to full 90 deg. position.

Mixed station has wheels are installed on both sides of pedestal, with the setting and off a placard on pilot's side. Although normal free control is in, though button on yoke, handles are folded into the wheels for manual operation. Another warning light on the copilot's side glows each time electrical trim change control is operating.

Parole brake handle and warning light are on the pilot's side, put off from the station from index.

#### Thrust Level Travel

Thrust levers travel approximately two thirds of the horizontal arc of the part of control pedestal. Last one third is occupied by engine fuel control levers, which have three position—off, cruise, shut and run with positive stops for each position.

Horizontal section of the pedestal extends at 90° with communications controls, engine controls installed. At the aft position are rudder trim wheel, under, and setting on the horizontal surface of pedestal, while the aileron trim wheel, under and setting are on back of the pedestal in a vertical plane. Aileron and rudder trim are controls manually operated.

The center overhead panel contains engine starting switches, pilot and co-pilot lights, flap electrical emergency operating switches, electrical switches and radio release switches, engine, wing and emergency engine controls and lights, overhead lighting controls and

spoiler deactivation selector switches. The panel also includes engine power gear, radio frequency switches, such as set belt, no smoking sign, emergency exit lights and the passenger oxygen master switch.

Other engine and system gauges and operating controls are on the right as given a panel including fuel management.

Now gear steering wheel is on left cockpit wall ahead of pilot's seat.

#### Test Checklist

Aviation Weir pilot's first complete left seat flight incorporated a regular IAR flight test card in addition to a checklist wall. Since the flight was official IAR, the checklist was not as has standard as all IAR flights are conducted right instrument conditions, with attendant engine and checklist at pilot's equipment.

One part of N707PA checklist which will apply to other, some flights is a cockpit checklist prior to engine start, accomplished with ground crew assistance.

Using hydraulic power from the electric driven pump, the spoiler and aileron trim are checked for operation, with the ground crew reporting actual surface movement to pilot on receiver. Flaps are checked at full. Standard control surface secondary tab movement is reported to the pilot by the ground crew. Once engine, one and greater (pushes) flight crew checking.

Engines were started with the airplane's self controlled high pressure fuel switches are used in starting on green cards with two positions. There is one switch for each engine, ignition system, with two positions, ground and flight start. The fifth switch is a master ground start selector for high (pilot's in bottle) or low (ground crew) pressure or supply.

Ground start selector switch is placed in the high pressure position and ignition switch for No. 1 engine is placed in ground start position. Flight engine selector switches are supplied and the combustion starter button engine start. As the first engine becomes airborne, the fuel control selector is moved from cutoff to start position. As No. number approximately 40%, the fuel control is moved into run position and ignition is turned off.

Completing the start No. 1 engine power is increased until the turbocharger pressure can be stated to deliver as to start the other engine ground selector switch is moved to low pressure position, and engines are started one by one, with the same fuel control sequencing.

Test control is by now wheel steering and can also be done by engine and brake manipulation. Dual use is now

potholes, etc. / gyro instruments / airframe products

## FLOATED GYROS



Daystrom Pacific develops and manufactures a complete line of floated 3 wire line gyro and floated rate gyro. A variety of standard and non-standard configurations for autopilot and stabilizing applications in the aircraft and marine industries are provided.

Davstrom Pacific, to better serve the customer, has standardized all basic components to reduce cost and increase lead time.

Other standard instrument products include:

- Angle of attack vane
- Inertia gyroscopes
- Inertial guidance systems
- Flap rate computers
- Ground alignment equipment
- Floated stable platform

For further information contact Davstrom Pacific—your products and services—please contact the factory direct.

**DAYSTROM PACIFIC**  
A Division of DAYSTRON, INC.  
1001 LINDSEY, BIRMINGHAM  
LOS ANGELES 44, CALIFORNIA

components for highly  
precision systems



In Europe  
DAYSTROM LTD.  
100 GERRARD ST. E.  
TORONTO 10, CANADA

Agents  
DAYSTROM LTD.  
100 GERRARD ST. E.  
TORONTO 10, CANADA

The advertisement features a large circular graphic on the left with the text "Delavan... a name to remember" and "Outstanding and manufacturing fast" in a smaller font. To the right of this is a smaller circular graphic with the text "Delavan Manufacturing Company" and "WEST 1000 N. 10TH, OMAHA". Below these is a large, stylized "DELAVAN" logo with "Manufacturing Company" underneath it. At the bottom right, it says "WEST 1000 N. 10TH, OMAHA".

slow handling is given as swift as high speed airplane.

Takel's direction detector that N706PA has the full 10,000 ft. of the entire runway at Boeing field. During taxi toward the runway center, the airplane was accelerated and thrust is taken directly to check operation.

Thrust reversers can only be operated when thrust levers are at idle. Reversers are actuated by pulling up and back on thrust control sticks. Thrust reversers like reverse propeller pitch control on some jet engine transports.

An reverse celerity close, accelerated stops are actuated and reversers levers pulled further back to attain

fast. Present procedure calls for up to 90% of the N706PA with the airplane slow to 60 kts. (IAS, when power is reduced to 15 EPR, when it starts until the 707 is stopped. If reverse operation is continued, the 707 backs up as well.

For the 707, N706PA, 218,000 lb. and takeoff was 5,100 ft. V<sub>1</sub> = 149 kts, V<sub>R</sub> = 159 kts, V<sub>2</sub> = 171 kts. Takeoff run was 5,100 ft.

Water injection for the 707 is on at both ascent and descent. The water cools down under ambient temperature is below 70°, under which water is injected only into diffuser. Addition of the water injection start switch causes

water tank pumps to deliver water to each engine, which has its own pump for proper pressure and an adjustable control valve to release water at proper power level for normal operation during take off and water, a normal switch must be thrown which allows water to flow into water.

Among perfect calculations is the EPR for takeoff which goes full rated power. Pilot advances thrust levers with propeller bucket set to the pre-determined value of which water must be injected into the jet (produces a definite power increase) and bucket then is released.

#### Jet Acceleration

Jet transport acceleration is slower than that of piston powered aircraft, but as bucket is released, a definite acceleration is felt which increases and continues throughout takeoff.

The pilot controls the engine thrust lever with movement up to approx. 100 ft. with left hand. The right hand stays on the thrust levers. Captain holds the stick forward to keep the airspeed at 180 ft. The pilot releases the throttle when the airspeed reaches the scheduled climb speed and the lever on stick in cockpit holds thrust levers at proper setting.

The pilot monitors stepped climb at V<sub>1</sub> as planned and, V<sub>2</sub> as planned. Airplane is initiated at V<sub>1</sub> and if rotation was proper, V<sub>2</sub> seems to arrive almost simultaneously with rotation completion, and airplane is airborne as acceleration continues. At rotation, the change in attack produces a changed feeling as stepped indicator, a slight dip, expressing a slight change in calculated speed. Gear is retracted and nose electronic climb initiated.

Pilot & Weather current guarantee for JT-14-C turbojet engine speed, maximum takeoff thrust of 13,400 lb. with 1 min operation showed at this power level. When operation last, approximately 15 min. leaving weather. It was maximum power operation at 1 min.

Definite deceleration is felt as water is cut, after which the thrust lever is adjusted to maintain the rated rate of water flow. Water is pumped from and back to high altitude cold.

After flap was retracted, aircraft was at proper airspeed and altitude for a steep climb speed of 278 ft. V<sub>2</sub> was increased for climb to altitude. This speed was used in Boeing flight test work, was changed to open test.

Engine power setting for climb is according to flight planning specifications for a certain climb rate as grab set, at the proper speed. Engines may be run at maximum continuous level at low.

Final sequencing involves about 100

to 100 ft. of ground, with current procedure calling for use of 3,000 to 10,000 ft. time area track first to prevent a 4 ft. CC shift. An altitude of 15,000 ft. will be used in an additional point to be reached before reaching track.

After initial main test, after the control section is used, with resulting accomplished as CG control required to the center. In the water, Table No. 1 and No. 2 have the same effect as CG shift.

Manual control of the 707-420 during climb and level flight requires active management of pitch trim, especially if pilots are moving bar and alt in the long feeling. Use of the manual trim control bar on the control yoke provides trim surface movement, and results in acceleration in short terms.

When on each flight conditions are being set up by the test design. Much time consumed with altitude hold makes the 707-420 a stable platform. These automatic controls provide the pilot with a set of auto without which flight with a load of moving personnel could be a real manual effort, with the inherent characteristics of the large aircraft wing.

In flight characteristics assessment, a plugged pitch mechanism (longitudinal) was released both with pitch trim and manually, and recovery accomplished. The a slight hold time proved a good technique with which the following the turn and to allow other area value from a slight rise or alt steady lead to desired.

Depth roll, the famous roll due to an updraft, was accomplished. The changed slightly after some practice in applying control forces against the motion of the proper combination as possible in the motion. A manual recovery method at depth roll was given a good recovery technique which was effective and easier to accomplish than the control bar application, which requires some practice for proper use.

In other plugged mechanism or Depth roll, use of suboptimal at the automatic flight control aids, individually would be more pilot effort.

As the test was completed, the 707-420 was brought to the ground at the Boeing 707-420 Transport. The second test (after in test work) times.

## Marine Corps Orders Hercules Transports

New York—Marine Corps has purchased version of two Lockheed C-130 Hercules transports from Lockheed's Georgia Division. Aircraft, scheduled for delivery in early 1960, will be given the USMC designation CV-1.

Aircraft will be used for light air-lifting and in aircraft transports. Additional orders are anticipated by Lockheed.

## advanced engineering opportunities with the TAPCO GROUP of Thompson Products, Inc.



REWARDING RESEARCH OPPORTUNITIES for engineering specialists now exist in the Advanced Engineering Department of the TAPCO GROUP at Thompson Products. This is a growing and expanding program. The TAPCO GROUP, made up of five major Thompson divisions, is serving the Aero-Space, Electronics, Nuclear and General Industrial fields with fully integrated facilities for research, development and production of structures, propulsion systems, electro-pneumatic-mechanical auxiliary and accessory power systems, electronic controls and check out equipment, and fuel systems involving solid-state, liquid and nuclear fuel systems.

If you would like to join the personnel of the Advanced Engineering Department in satisfying work at the forefront of knowledge in these areas, there are opportunities for men with the following experience:

**GAS DYNAMICS**—Internal and external flow, single and two phase flows, entrance and exit flow flows.

**HYDRODYNAMICS**—Experience in boundary layer evolution and control.

**APPLIED MECHANICS SPECIALIST**—Experience in structures, system analysis, system analysis and simulation techniques.

**PROPULSION SPECIALIST**—Familiar with gas dynamics and thermodynamics of rocket flows and combustion of solid and liquid propellants.

**INFORMATION THEORY ANALYST**—Experience in mathematical analysis of controlled and stochastic systems, information and control.

**PHYSICIST**—Familiar with the physics of gases and fluids, mechanical and electrodynamic wave propagation within these media.

**SOLID STATE PHYSICIST**—To work on electronic circuits.

**MAGNETIC HYDRODYNAMICS**—To work on advanced propulsion systems.

**APPLIED MATHEMATICS**—Experience in logical programming of systems, and work in communications and probability theory.

Your complete resume should contain personal, educational, experience data, and salary requirements. Send to: DIRECTOR OF PLACEMENT, All replies will be held in strict confidence.

**Thompson Products, Inc.**

20000 BUCKLE AVE. • CLEVELAND 17, OHIO  
Phone: (216) 441-7600, Extension 402, 703

Founded in 1901 Plants in 12 Cities

Advanced Research and Development Centers



**PRECISION MACHINES HONEYCOMB CORES TO ANY SHAPE**  
• COMPOUND CONTOURS  
• TAPERED AND FLAT

Now...substantial savings in tool costs and machine time available to you.



G-4 machine, shown operating in refrigerated chamber, shapes plastic moldable urea that has been filled with water and frozen. Shear forces cut of block into cylinders forming problems. Send for illustrated literature.

Take advantage of our Special 10th and Experience in Core Shaping. Molding, drilling, tapping, reaming and contour (curved and square) forming using new parallel lines in a single, forming and electronic applications as well as positive profiles.

In numerous areas of key size or shape, stresses are uniformly distributed throughout the part without stress concentrations. This produces free unbalanced fatigue and vibration resistance. Various materials machined—Stainless Steel, Aluminum, Steel, Copper, Brass, Titanium, and other heat treatments. G-4 handles materials up to 14" by 10" and 2" thick. Airbrushed—Improved Aerodynamic performance, appearance, freedom from leading edge erosion and distortion.

**U. S. PROPELLERS, INC.** A subsidiary of

Honeycomb Corporation  
Selling agent  
10111 MONTGOMERY ST. - PACHOMA, CALIF.  
**TURBO PRODUCTS INC.**

ENGINEERS—INVESTIGATE JOB OPPORTUNITIES WITH A FUTURE







## AEROJET for rocket power

### AIR FORCE's TITAN

The liquid-propellant  
rocket engines  
for the Air Force TITAN ICBM  
were designed and  
developed at  
our Liquid Rocket Plant  
near Sacramento—  
America's largest industrial  
rocket facility.  
Production engines are  
now being delivered.

AEROJET-GENERAL CORP.

THE  
GENERAL  
TIRE

A SUBSIDIARY OF THE GENERAL TIRE & RUBBER COMPANY

Engineers, scientists—accept outstanding opportunities at Aerojet. (Plants in Azusa and near Sacramento, Calif.)

Automatic pressure and of shanes, air  
clouds. Top and bottom of cloud  
lance from ground level up to 100,000  
ft. will be covered with a hand vertical  
scanning radar system. A C band, low  
power scanning radar will be used to  
find storm formations up to 150 mi.  
from the aircraft. Data processing equip-  
ment will give the best shape, intensity  
and movement of the storm.

Vertical scanning from ground level to  
100,000 ft. will be carried out with ex-  
pendable dropsondes and rocketsondes.  
These will be loaded in automatic  
ground support equipment into a dis-  
penser located at the rear of the air-  
craft.

The weather observer will sit a pro-  
grammer for the desired sounding in-  
formation, which can be as short as 100 sec-  
ond. This will control the automatic dis-  
penser. A dropsonde and a rocketsonde  
payloads will be ejected in pairs, but  
the pattern can be varied. Each sonde  
will be automatically timed for proper  
transmitting frequency and checked out  
prior to ejection. If a fault is re-  
vealed, it will be ejected and a new one  
dropped into place. They will then be  
ejected upward, either be compressed  
as an mechanical means at an altitude  
of approximately 50,000 ft.

Dropsondes will descend by para-  
chute at an average rate of 75 ft/sec.,  
thereby keeping instruments close to  
aircraft 125 mi., and will contain the  
following equipment:

- UHF radiofrequency to measure index  
of refraction.
- Micro-mechanical equipment to deter-  
mine storm parameters.
- Automatic warning photometer to deter-  
mine rain rate.
- Rotating mirror photometer to mea-  
sure winds.
- Aneroid pressure sensor to record pres-  
sure.
- Thermistor to measure temperature.  
This will be located at the end of a  
boom that retracts after ejection.

At the top of the instrument package  
will be a transmitter case inside battery  
and a pulse coder for transmitting the  
data.

The rocketsondes will be ejected in a  
launching tube which will descend  
in parachute until it becomes vertically  
stabilized. An automatic timer then  
will fire the rocket from the tube in an  
altitude of approximately 150,000 ft.  
Once the rocket is free of the tube, the  
fan folded at its base will snap open  
and lock into place.

At 150,000 ft., the protective nose  
cone drops away and the nose package  
falls free and begins its parachute de-  
cent. Construction of the rocketsonde  
instrument package will be the same  
as that of the dropsonde except a ball-  
ing point hypsometer will be used for  
high altitude pressure sensing.

The complete automatic vehicle

Major Southern California  
missile operation has  
**immediate openings**  
for qualified graduate  
engineers with experience in

### Instrumentation Systems

with general knowledge of missile systems, including  
propulsion, guidance, structure and electrical systems

### Guidance Systems

Experienced in research and testing of practical hardware, and  
with mathematical background for system analysis

### Flight Test

Background should qualify for planning and coordinating  
entire flight test progress

### Aerodynamics

Must be able to analyze missile configuration to determine  
aerodynamic performance and stability and control  
characteristics

Well paid jobs  
for qualified people

Relocating expenses paid.

For information on these and other engineering positions, write:

Mr. H. A. Roberts, Dept. 411  
Mano Development  
North American Aviation, Inc.  
12214 Lakewood Blvd., Downey, California

# T-J spacemaker cylinder

## Quality Engineered

to give quality results

with Extras...  
at No Extra Cost!



You get more—much more—when you specify and use any of T-J's complete line of Spacemaker cylinders. The Spacemaker is engineered to give you better, more accurate, and longer service—often, exclusively, than ours—that are STANDARD, AT NO EXTRA COST!

Designed to eliminate in-flight, providing greater strength... more space... reduces outboard and costs in all push-pull-fli operations. IMMEDIATE SHIPMENT in a wide range of sizes and capacities, with 64,000 combinations. Write for Bulletin SM 155-3 with complete engineering details. The Tomkins-Johnson Co., Jackson, 38302

**TJ TOMKINS-JOHNSON**  
DESIGN, MANUFACTURE, SERVICE, SUPPORT

**METAL PISTON AND CRANK**—Standard at No Extra Cost  
**NEW "BURNER" PISTON FOR AIR**—Standard at No Extra Cost  
**CHROME PLATED CYLINDER, PISTON, AND PISTON RING**—Standard at No Extra Cost  
**ONE-Piece PISTON**—Standard at No Extra Cost  
**NEW "SELF-ALIGNING" WEATHER COUPLER FOR HYDRAULIC OIL**—Standard at No Extra Cost  
**NO TO ROBB TO VIBRATION**—Standard at No Extra Cost  
**STREAMLINED DESIGN**—On Pressure to 750 P.S.I.—on to 200 P.S.I.—Standard at No Extra Cost  
**FORGED 50 TO 500, 6000, 8000**—Standard at No Extra Cost

will be approximately 6 ft long and 6 in. diameter and will weigh about 120 lb.

Scanned data from all sensors will be fed through conversion and buffers to a general purpose digital computer at the aircraft. Reference data from the aircraft will also be added and the processed data will then be recorded on magnetic tape.

Synoptic and operational data will be transmitted in digital form in code to USAF ground stations. Plans call for the direct entry of AN/AMQ-15 data into the new Weapons Station, 415 L data processing and 196-L global communication networks. Also the complete weather reconnaissance system, WS-464 L, is designed to be compatible with both an all-weather and an all-weather control.

The WS-464 L aircraft will carry a three-sensor weather reconnaissance crew in addition to its regular crew. There will be a weather observer at the front of the cabin who will establish operating conditions, monitor performance and flight parameters, and interpret storm radar display. At the control console will be a weather technician who will make payload and weight component checks and prepare special reports for transmission to the ground. An air sampling operator will be located at the rear of the cabin and will



ROCKETMOTOR is ejected from aircraft by launching tube which disintegrates by post-chute until stabilized retroblast.



**WEATHER** view will consist of a weather observer at front console, a weather technician at the control console and an air sampling operator at rear console.

control and monitor the sampling retroblast.

All that is presently specified about the aircraft still is that it is a multi-jet transport jet vehicle. The KC-119 jet tanker would make an ideal carrier, according to Louis G. Young, Senior Staff's Director of Long Range Plans, says, but Strategic Air Command has a high priority on this aircraft. Definitely word on the choice of an operational WS-464 L aircraft is expected soon, says Tom Deady.

Meanwhile, Bendix plans to run out all its development flight testing in the Boeing 167-40 prototype jet transport which is owned by its principal subcontractor. In having three operational jet transport at hand, the Bendix-Boeing team gained a definite advantage over other teams which had no jet transport.

Integration of all the electronic and mechanical equipment which comprises AN/AMQ-15 into a high performance jet aircraft is expected to prove a major system design undertaking, according to the industry. Among other things, the technical performance of the system itself be as high as possible without creating weight and drag penalties that would require the aircraft's extension of the mission. Thus, sensors, probes, antennas and antennas not Bendix, must be and will be kept to a minimum. Performance of the rocket motor sensors must be balanced, in turn, against sensor size and weight, rocket size and weight, and aircraft payload capabilities.

In setting up the mission profile for the AN/AMQ-15, the sensors chosen to transmit meteorological and geophysical parameters which are expected to be of great importance and which are now being assigned accordingly or not at all. But as new information develops, requirements require and aircraft performance advances, the mis-

sion profile is expected to change.

In the future, says Bendix, retroblasts may be added to passive radio-free from area space-electromagnetic effects, different atmospheric conditions and new features that may prove important to combat life and defense. Moreover, Bendix will try to extend vehicle concept of a future AN/AMQ-15 system to 500,000 ft.

Reaching this altitude will depend most upon new developments in rockets.

## Electronics Engineers:

### HELP WRITE THE BOOK AT RYAN

Here is a work an electronics man advanced that much of it has actually become standard text for industry and schools.

Today you can help us write the book in combination with other authors. For experience, provide guide our, and help support our research.

- Design Engineers
- Electronic Engineers
- Microwave Engineers
- Reliability Engineers
- Field Service Engineers

For details write to J. R. Johnson  
**RYAN**  
AERONAUTICAL  
COMPANY  
2132 AMBROSIO DRIVE  
San Diego 12, California

Compare ALL your  
distribution costs...

You'll find

**DELTA**  
**Air Freight**  
costs less  
than you think!



Call Delta Air Lines  
for more General Office  
Service Agents, Airline, Inc.

NOT COMPLETE ALL CARGO SERVICE TO AND FROM THE SOUTH

HANDLING  
INSURANCE  
CIRCUIT  
DISTRIBUTION  
WAREHOUSING  
INVENTORIES  
CAPITAL TIE-UP

## Mission Profile

New WS 401, weather reconnaissance unit will provide atmospheric measurements on a global scale, rapidly acquiring data on a routine operational basis. Following are the 13 meteorological and geophysical parameters that will be measured and the ranges within which they will be recorded automatically by the new AN/AMQ-15 weather station receiver system.

|                      |                              |
|----------------------|------------------------------|
| Pressure             | 0 to 1050 millibars          |
| Temperature          | 84C to -54C                  |
| Dew Point            | -54C to -15C                 |
| Wind speed           | 0 to 70 kts/hrs              |
| Wind dir             | 0 to 355 in Azim             |
| Wind                 | 0 to 100 kts                 |
| Visibility           | 0 to infinity                |
| Altitude Rate        | 0 to 1                       |
| Radius of Reflection | 0 to 400 N. units            |
| Clouds               | 0 to 10 x 10° milibars (NPT) |
| RAI Value            | (0 to 100)                   |
| Conductivity         | 2 to 10 x 10° mhos/cm        |
| Potential Gradient   | 0 to 10 x 10° volts/meter    |

and instruments than upon advances in aircraft performance. Perhaps 10,000 ft of the additional 150,000 ft. Young says, will be gained through improved aircraft performance. The rest will have to come through new and more powerful cockpit populations and smaller and lighter instruments.

Only one to be NATIONAL

# PLASTICS

EXPOSITION

INTERNATIONAL AMPHITHEATRE  
CHICAGO, ILL.

NOV. 17-21

What's new in plastics? Visit the show and keep abreast of this ever-changing industry. See all that's latest and best... new plastics you can use in your products. New equipment to speed production... find out how to make bigger profits through use of plastics. Watch for true trends now... use your company literature, please—the general public won't be admitted.

FIND OUT HOW YOU CAN USE "PLASTICS FOR PROFITS"

SPONSORED BY THE SOCIETY OF THE PLASTICS INDUSTRY, INC.  
220 Park Avenue, New York 17, N.Y.

Keeping the AN/AMQ-15 program current, particularly during development, will be a prime responsibility of Bendix Systems Division. About a difficult problem with new systems, it is expected to prove especially so with the AN/AMQ-15 because of the requirement for a built-in growth potential. Bendix will have to meet combining new systems, Young notes, adding new parameters to the station profile or dropping established ones as desired.

The emphasis during the design period will be on the development of a system with growth—care that can be used as a template, with an eye to other aircraft. The AN/AMQ-15 will also be a system that can be used in combination with other airborne weapon systems, most important, perhaps, it will be a system that can serve as a building block for future sophisticated systems. Flexibility will be the keynote, says Young, both in design and in thinking.

The AN/AMQ-15 program marks the first time in the 15-year history of weather reconnaissance that new weather reconnaissance equipment has been designed as an integrated system and not just as the pattern for future work in this field. The project also is a good example of the new team effort that is becoming an established trend in the aviation industry.

## ACOUSTICAL ENGINEERS

Immediate opening for top level men, qualified to work up to engineering status, to work on the most advanced weapon systems in the B-70 and the F-105 and the X-15—first manned space ship.

He should have a background in EE, ME, or Physics, with at least an several years experience in acoustics.

He'll calculate and measure sound levels for soundproofing procedures to insure crew comfort and efficiency; and work on sound environment problems on equipment of particular airplanes and structural fatigue problems resulting from high acoustical levels.

There are also challenging opportunities for less experienced acoustical engineers.

Write to: Mr. A. K. Stevenson, Engineering Personnel, North American Aviation, Inc., Los Angeles 64, California.

THE LOS ANGELES DIVISION OF  
**NORTH AMERICAN AVIATION, INC.**



work in the fields of the future of MAA

Because of the size of the program, the Air Force felt that it was too big a job for one company. At the same time, the Air Force wanted industry to handle the complete program and to adjust its bids as the total effort. In preparation for the bidding, the Air Force conducted two technical meetings at Wright Patterson AFB, Dayton, Ohio.

Seven teams, consisting of approximately 55 separate groups, bid for the project.

Each team was questioned by one company that was to act as the system manager. (The Bendix-Boring team was the only one which didn't come out with a number of subcontractors.) Bendix is strongly against such commitments, preferring instead to ensure all proposals—plus those from members of the other team—will then act as an advisory capacity to the Air Force. Total weight of the system proposal for the project was about two tons.

Bendix Aviation Corp., through its Systems Division, was selected as the prime contractor and system manager. Seven other Bendix divisions will join with the Systems Division to provide system design, instruments and sensors, sonic sensors, data processing, valves, ground support equipment, parts of the air sampling stations and related data.

Boring Aerospace Co. is the major subcontractor and will make available 4,757 man-hours per hour for flight testing and all in Seattle for two. Boring will also be responsible for radars and antennas, video in stills, flight test, sonic detectors, thermopiles, electronics, hardware, equipment, parts of the air sampling system, wind tunnel testing and aircraft integration.

Work on airborne computing and recording equipment, miniature electronics, laser data, vibration suppression sensors, and radars will be subcontracted to eight other companies and universities.

Concerning the program set in addition to the Air Force, the program is a management board which supervises top management of Bendix and Boring, a technical advisory committee, which is made up of outside consultants and key technical staff from Bendix and Boring and a program management council which will coordinate all participating groups at the program management level.

The key individuals in the project are Frederick B. Chase of Bendix Systems Division, program director; Roger Sisk of the Aeronautical Research Laboratories, project engineer; F. W. Kirch of the Air Materiel Command contracting office; and B. E. Walsh of AMC, buyer.

## NOW AVAILABLE! NEW RADIATION, INC. Short Form Catalog 1-58



- TELEMETRY EQUIPMENT • RECORDING SYSTEMS
- TEST EQUIPMENT • DATA PROCESSING EQUIPMENT

Designed and built to existing specifications for use where outstanding reliability and ruggedness are absolute requirements.

The coupon below is sent for your Radiation, Inc. Short Form Catalog 1-58 and to receive future catalogs.

**RADIATION, INC.**

MEMPHIS AND OAKLAND, ALABAMA  
Atlanta • Chicago • Dallas • Fort Worth

Personal Enquiries Invited

RADIATION, INC.  
P. O. BOX 37, MELBOURNE, FLORIDA

AY 18

☐ Send Catalog ☐ Send me future bulletins

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_ ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

**SECRET  
OF  
SUCCESS**

*Here's why  
the Cole Connector®  
functions dependably,  
easily despite possible  
misalignment*

**SECRET  
OF  
SUCCESS**

*Here's why  
the Cole Connector®  
functions dependably,  
easily despite possible  
misalignment*

This compact pin and sleeve are the secret of success of the revolutionary new Cole Electrical Connector - the reason junction can always be made quickly, easily, positively - even though pins may have become misaligned due to rough treatment, high shock, vibration or temperature.

The unique two ball and socket action of the contact is that of a universal joint, permitting unusual flexibility and allowing pins to be inserted at an angle. Far less pressure is required to close than with con-

ventional connectors. A basic seal of the basic terminal arrangement is possible. For high temperature use, ceramic parts can be used.

The Cole Connector can be made with any number of contacts, in any size or shape from miniature to high-capacity print. Because close tolerances are not required, special designs can be efficiently manufactured in small quantities. This may be the solution to your connector problem. Write us regarding your requirements.

Some of the more than 1,500 APPLICATIONS of the Cole Connector submitted since its recent introduction:

Aircraft  
Wires  
Electronics  
Thermal Energy  
Automation  
Logistics  
Test Equipment  
Instrumentation  
Electrical Machinery  
Fixed Tooling  
Army Ordnance  
Stores

Steel Mills  
Computers  
Communications  
Hazardous Waste  
Pollution  
Rocket Engines  
Fire Control Systems  
Machine Tools  
Explosive Motors  
Oil Well Equipment  
Underwater Warfare  
Automobiles

Business Machines  
 Seed Machinery  
 Pulp and Paper Machinery  
 Textiles  
 Electrical  
 Printing  
 Power Transmission  
 Marine Equipment  
 Pumps  
 Appliances  
 Transportation

Theoretical Equipment  
Air Conditioning  
Tire Machine  
Brake Support Equipment  
Welding/10  
Compressor  
Electronic Cables  
Dry Sealing  
Medical Equipment  
Sewer 10  
Mats  
Laboratory Equipment

Cable Connectors can be made in any size, shape or capacity and with any number of contacts.



**Cole**  
ELECTRIC CO.

8439 Stellar Drive  
Calver City, Calif  
91604

Effluent applied for



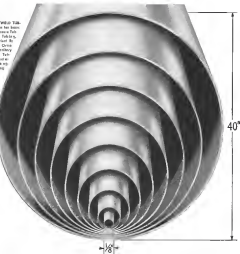
## F8U-1s Accompany Regulus II On First Submarine Launching

Reggie II is positioned on USS Grayback (diesel) prior to firing of the Chance Vought missile from a submarine (AW Sept. 12, p. 27). At left, Aerojet-General booster rocket is started, and Chance Vought FGU-1 chase planes, speed brakes extended, pass by. Below, Reggie II becomes airborne and overrules chase plane. Booster will soon drop off and GE IT-5 paravels there.





CONTOUR TRENTEWELD TUBING is fabricated in ten basic diameters—Passive Tubing, Machine Cut Tubing, Aircraft Tubing, Heat Exchanger Tubing, Drive Shaft Tubing, Drilling Tubing, Borehole Tubing, Large Diameter Tubing, and Small Diameter Tubing.



## TRENTWELD tubing is equal in strength and has more uniformity than tubing made by any other method of manufacture

Trent offers tubing in sizes ranging from 1/4" to 60" O.D. and in a wide range of grades. These include: Hastelloy, Inconel, Monel, Titanium, and 20-25-50, grades. All are made by an exclusive welding process—Contour Trentweld®—which virtually eliminates the bead. Furthermore, by cold working and annealing after welding, Trent makes the weld equal in strength and corrosion resistance to the parent metal.

To insure that Trentweld tubing

is of the highest quality available, a rigorous quality control program is carried out. Samples of each lot are tested. Periodic tests—fatigue, reverse bend, flay and flange, coil, and pressure—are conducted. Rigorous non-destructive tests are made on all lots intended for corrosive applications. When requested, a unique "simple-weld" X-ray inspection is made as your final assurance of a sound, uniform product.

Why not take advantage of Trent

quality when you order stainless or high alloy tubing? For further information, write for the Trent tubing handbook, Trent Tube Company, East Troy, Wisconsin.

Member of the American Society of Mechanical Engineers



**TRENT  
TUBE  
COMPANY**

Subsidiary of Lincoln Steel Company of Illinois  
GENERAL OFFICE: EAST TROY, WISCONSIN  
MAILS: EAST TROY, WIS. FULLERTON, CALIF.

"speak the same language" or at least employ codes which can be easily translated without elaborate conversion equipment and consequently time delays. Furthermore, the rate at which data can be exchanged between computers will depend upon the type of communication links available between the two machines which means that computer and communication capabilities must be carefully coordinated.

Mr. Gen Victor B. Haugen, director of systems management, heads up all Weapons Systems Project Offices and Electronic Supporting Systems Project Offices, and Col. William H. Condon is in charge for ESSPOs. Most of the Electronic Supporting Systems Project Offices are located at Wright-Patterson AFB in Dayton. The Continental Air Command and Warning System, DEW Line, and Ballistic Missile Early Warning System project offices are located in New York City, concurrently with the system engineering staffs of Western Electric and American Telephone & Telegraph Co. which are major contributors to these three programs.

During the development phase, the Electronic Supporting Systems Project Office is headed by a representative of the Air Research and Development Command, with an Air Material Command representative taking over when the program moves into production. Such groups are represented, however, throughout the life of the program. Six of an ESSPO staff stages from a handful to as many as 40, depending upon the program and its status.

### Procurement Offices

One difference between a WSPPO and ESSPO is in the procurement setting. Col. Condon heads up the Weapons WSPPO staff normally retains an AMC procurement representative, all ESSPO procurement matters are handled by the Rome Air Force Depot, Rome, N. Y. The AMC personnel on the ESSPO staff are responsible for getting the system into service and seeing that production, supply and maintenance problems.

There is another difference in the procurement area between weapon system and electronic supporting systems programs. Presumably every weapon system is funded as a package item, whereas the electronic supporting systems frequently are authorized on a piecemeal basis.

The Intelligence Data Handling System (IHDS) and Global Weather Reconnaissance System (GWSR) have not yet been fully funded, however are being carried out in stages.

An F-4 recently awarded a contract to Bendix Aviation to develop advanced instrumentation and to perfect jet-surface-podding aircraft as part of IHDS. The Bendix program is identified

# AERODYNAMICISTS

## EXCEPTIONAL OPPORTUNITIES ON CHALLENGING, LONG-RANGE PROGRAMS

Bell Aircraft's expansion in three major fields has created high level positions on advanced analytical and development programs. Immediate openings include:

### SPACE FLIGHT "Dyna-Soar"

#### GROUP LEADER FOR HEAT TRANSFER ANALYSIS

##### SENIOR ENGINEERS FOR:

- Gasdynamics Research • Stability and Control
- Static and Dynamic Aerostability • Pitcher

### AIRCRAFT Jet VTOL

#### GROUP LEADERS FOR:

- Stability and Control • Installed Engine Performance

##### SENIOR ENGINEERS FOR:

- Static Aerostability and Pitcher • Advanced Aerodynamic Design • Flight Control Systems Analysis • Aerodynamic Testing • Aerodynamic Heating Analysis

### MISSILES Advanced Design

#### GROUP LEADERS FOR:

- Flight Control Systems • Stability and Control
- Performance

##### SENIOR ENGINEERS FOR:

- Performance • Stability and Control

Send your resumes today to learn about these assignments and the unusual opportunities they offer you for rapid advancement and professional growth. Liberal salaries and fringe benefits. And you'll find good living for you and your family with successful cultural and recreational advantages in the beautiful Niagara Frontier.

Write: Supv., Engineering Employment, Dept. 4-32

**BELL AIRCRAFT CORPORATION**

Buffalo 5, New York

Bell Aircraft Corporation is a member of the Western Bell Industry team developing the Dyna-Soar hypersonic glider for the U. S. Air Force. Other team members are the Morton Company, Bendix Aviation Corporation, Minneapolis Honeywell, Hughes Aircraft Company, Goodyear Aircraft Company and American Machine and Foundry Company.





## STRAIGHT TALK TO ENGINEERS

*from Donald W. Douglas, Jr.*

*President, Douglas Aircraft Company*

You may wonder what the future holds for the engineer who decides to build his career in the aircraft/missile industry.

In terms of permanent demand, this industry probably requires a greater proportion of engineers to total personnel than any other. Here at Douglas we are now employing more engineers than we did during World War II.

In regard to professional standing, the aircraft/missile industry deals always with the

latest state of the art in every engineering and scientific specialty involved. Its engineers are in one of the best informed and highest prestige fields in their profession.

Whatever your present activity, if you decide to move into aircraft, missile and space technology, we would like to talk with you.

Please write to Mr. C. C. LaVene,  
Douglas Aircraft Company, Box 600-31,  
Santa Monica, California

in Wargame System 4611, because it will accompany the pit entrance as well as reconnaissance, but it will march serve as an "input" or "output" for the ground-based system which analyses data from a variety of such sources.

### Shocking Glitch

There is no pit in the space of military aircraft and missiles requires at least a reconnaissance element in the line required to transmit vital military information from distant sites to command headquarters. The various and complex of a system requires to keep pace with hypersonic vehicle speeds and global operations suggests that the future will see increasing use of the network management approach.



### Semiconductor Device Based on Hall Effect

Semiconductor device whose output is controlled by the product of its input current and the applied magnetic field has been developed and is now in production at Ohio Semiconductor, Inc. of Columbus, Ohio, called a Halltron because its operation is based upon the Hall effect, one of a number of different functions in atomic equipment.

- D.C. to a.c. converter
- Low-frequency oscillator or amplifier
- Analog computer element
- Magnetic amplifier
- Motor torque sensor
- Magnetometer or compass element
- Static pulse generator

A whole family of Hall Effect devices was produced nearly two years ago at an international semiconductor symposium in New York by Dr. T. S. Moss of the British Royal Aircraft Establishment in reporting on British work on the new semiconductor device. (AVR 13, 1967, p. 101)

Ohio Semiconductor reports it can produce a variety of Halltrons from different compounds of silicon and germanium and indium-arsenic. Model HS 51, now in production, comes in a ceramic encapsulated unit which measures only 0.5x0.4x0.3 in.

The HS 51 delivers output voltage greater than 500 mv with input current of 500 ma and a 10 Vdc supply range field of several times ambient with



For example, Rohr builds the compressor, vane-bearing sections, jet pods and nozzles, second stage nozzles and the fuel nozzles, and the nozzles of the engines for the giant, new Boeing 707 Aircraft, as shown above.

The fact that our record backlog figure is over 50% commercial contracts is just one of many reasons Rohr offers unusual security along with professional growth to highly-skilled aircraft engineers.\*

Please forward resume to J. L. Hubel, Industrial Relations Manager, Rohr Aircraft Corporation, Chula Vista, California, Dept. 4.  
\* Citizenship required.



Chula Vista and Escondido, California



# DYNA-SOAR...



**DYNA-SOAR...** An important step forward into the Space Age marked the award of preliminary design contracts for this advanced vehicle to the Glenn L. Martin and Boeing Aircraft Companies heading competing design teams. Dyna-Soar will be designed to glide around the world in a series of steps of speeds in excess of 17,000 M.P.H. Its mission is orbital reconnaissance, strategic bombing and did in exploring the fringes of outer space.

Like other developments in Space Technology, Dyna-Soar, even though not scheduled to fly until the

1960's, will affect thousands of buying decisions tomorrow, next week, next month. AVIATION WEEK anticipated this kind of vehicle in its March 10, 1957 issue—has also described it in other technical articles—in the November 11 and December 16 issues of last year, and in the "Research for Space" edition of June 16, 1958.

The most authoritative source on Space Technology, AVIATION WEEK is also your most effective advertising medium to the entire Aviation industry including the multi-billion dollar Space Technology market.

**SPACE TECHNOLOGY** encompasses all of man's efforts directed to the exploration of the universe. First he attempts to overcome the basic laws of nature and the earth is freed by man and machines throughout the solar system and beyond. Man and his machines... a craft—vehicle... means vehicles... are based on earth, and must deal with the earth's environment in order to reach these outer space. They must also deal with hostile unknown environments.

Space Technology therefore includes every branch of the physical and life sciences and every facet of engineering necessary to combine these sciences into successful flight through space.

Sell Today the Market of Tomorrow!  
**SPACE TECHNOLOGY**

**Aviation Week**  
*Leading Space Technology*

A. McGraw-Hill Publications  
330 West 42nd Street, New York 36, N. Y.



# solid footing?

To a man floating weightless around Space Station C, there are perhaps meaningless words—but solid footing is highly important to most of us who live and work on the surface of the earth.

Autonetics has established a solid footing in critical positions through 12 years of successful development and production of airborne and space-based systems, as well as systems for space applications.

The healthy growth of the Autonetics Guidance Engineering department—based on a number of highly diversified contracts—has created new, secure-

level positions in the fields of electro-mechanical development and system analysis.

Well-qualified, experienced men with solid footing in this position, progressive, and successful in promoting—plus the chance to create and to grow as one of today's most challenging fields.

But that's a waiting. Now is the time to find out what the future holds for you at Autonetics.

Please send your resume to Mr. C. K. Blevins, Manager, Employment Services, 9550 E. Imperial Highway, Downey, California.

MEMBER COMPANY OF THE NEW INDUSTRIES, INC.

**Autonetics**

A DIVISION OF NORTH AMERICAN AVIATION, INC.



FOR PERCIN (left) measuring into jet stage at Mach-20/200 ft (lower left)

to take up the space difference in diameters of stage 1 and stage 2. The coils cause them to swing stage 2 from its own thrust into position over stage 1 and make the two assemblies at ground level platform level; the elevator is again lowered to position the top of stage 2 for one cone attachment at ground level.

Now one is removed by the MC-1 crane from the transport track, attached to a positioning frame on which the cone is mounted upside down. MC-1's cone is fitted with a Mifco Model Set device, engaged with a double-acting hydraulic cylinder having an automatic venting pump. Remote control lines to the Mifco-Set permit extremely accurate positioning of the cone over top stage 1; the cone mechanism provides visual gap of the cone cone weight.

Later, during a separate check, after it shows the operator whether the cone is being lowered square onto the second stage.

When the cone is assembled to the second stage, the vehicle leaves the solo area, after the transport's ground level work platform is scanned and the elevator platform is lowered further and the airfield doors are closed.

It is estimated by American Machine engineers that it takes approximately 35 min to position each stage after removal from their containers. 1-1/2 to explore the nose cone. Total handling time is probably only about one-third of that required to get the missile in readiness for firing.

Vertical under-ground storage of Titans (and upcoming Minutemen) occupies a "shelving" installation concept under which the USAF would have approximately 15 min to let go its striking power after the Soviets launched an attacking force. The possibility that U.S. would have time for only one round of retaliation

ICBM is designed to let the Soviets launch or harder than this but is in the hands for read-quilt one-third.

Demonstration of a pick-up Titan on a dummy site was recently given some 200 personnel from various USAF commands and Ballistic Missile Division at Mitchell AFB recently (AW Sept. 15, p. 39), whose development engineering inspectors (DEI) now held simulated Titan was composed of rectangular, tube-covered stages resembling actual ICBM cone in weight, dimensions and balance; two models were loaded up to represent the actual dimensions on which the two stages rested.

Only the first stage was removed from its simulated transporter and positioned in the assembly area, which was only a few feet deep. On the first day DEI team requested that greater than ambient wind factor be provided during handling to better represent field conditions; a Douglas B-26 was parked near the area and engines ran up providing wind of approximately 35 mph across the site with gusts of 40-45 mph. AMF then exploded first stage, weighing an estimated 3,000 lb., in 74 min.

Second engagement in AMF handling system is Atlas 1010 cone, which has a 100-ft boom and is capable of handling loads up to 10 tons. Condule-electric 1010 has screw-driven motors for each section. On starting any motor, the corresponding control lever in the cab (there are no gears to shift) is positioned and the throttle is depressed gradually increasing pressure until speed slows down.

Engagement is arranged so that the engine cannot be stalled, yet accurate stopping speeds are possible for precise maneuvering. Safety devices to prevent overwinding and/or over-declining are installed in the system and a warning light when bells the operator when the lever is at correct index for lifting the cone, when it is at the right angle for setting at about and when it is at the proper angle for lowering. Should the attempt to exceed these positions, the action will halt and the operator can only adjust the boom to the proper attitude or lift or the load to the proper Controls have to be set into position prior to any use of the crane in order to prevent matching loads outside, which might occur if motion were applied while engine was at high speed.

Additional feature is remote control unit, which permits cone operator to position load accurately, then shows a switch transferring control to a hand-held console used by a technician on the ground who is free to walk about and precisely maneuver the missile stages into place.

After stages are positioned and lugs detached, ground operator can slow boom away from the site and control is returned by cone to cab.

are  
you



using  
only  
**HALF**  
your  
potential

in your present job?

Because of the diversity and rapidly increasing demands for test products, you have the challenging opportunity here at Bendix/Racal to contribute fully apply all your talents.

There are important career trends now NOK at all levels in our small, advanced engineering group in these fields —

**MISSILE GUIDANCE • TRANSMITTERS • AIRBORNE RADAR • MISSILE HYDRAULICS & MACHINE HYDRAULICS • SONAR & ARTI-SUMMARY WARRIOR**

Please write W.C. Mullen, your recruitment manager, or call to the coupon and mail it today.

W.C. Mullen, Director of Employment, Bendix/Racal, 10000 Northway Drive, Detroit, Michigan 48205. I am interested in the following position: ☐ Electronics Engineering ☐ Mechanical Engineering ☐ Test Engineering ☐ Other: ☐

I am not a graduate engineer and have ☐ years experience.

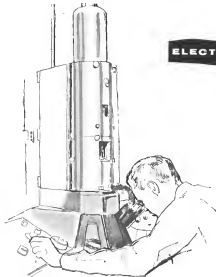
Age:

Address:

City:

State:

## ELECTRONICS



### SAN ANTONIO... IDEAL FOR ELECTRONICS

#### Labor Resources...

- Over 3000 now employed in electronics...
- Over 2000 now employed in research and development
- Ready pool of trainable labor
- Manufacturing employees wage rate 25% lower than national average. (Bureau of Labor statistics.)
- Work stoppage virtually unknown.

#### Living Conditions...

- Average mean temperature 50.6 degrees winter, 81.4 summer
- Outdoor living year round.
- 2600 acres of parks

- Housing: fishing, motor boating, water skiing
- 3 hours to golf coast and Old Mexico
- Old world atmosphere features the Alamo, 4 other Missions, La Villita and many other historic sites

In addition to excelling in labor resources and living conditions San Antonio offers all the other locational factors—good government, banks that support industry, abundant electricity, natural gas and water, excellent roads, good transportation and distribution facilities, equitable taxes, plenty of room for industrial expansion.



### SAN ANTONIO

For a detailed study of your specific needs  
Write Greater San Antonio Development Committee  
152 N. Main, P.O. Box 1187, San Antonio, Texas

All communications confidential

## WHO'S WHERE

(Continued from page 21)

### Changes

Charles B. Russell, Jr., director of maintenance, equipment and engineering, The Waco Electric Corp., Norfolk, Conn.  
Arthur E. Schindler, general manager, Electronic Specialty Corporation, 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.  
W. C. Smith, Jr., president, General Electric Co., Inc., Springfield, Mass.

Frank J. Sweeney, sales manager, The Waco Electric Corp., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.  
A. J. Tuck, sales manager, Electrical Division, The Waco Electric Corp., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.

John F. Tuck, head of section, sales, Electrical Products Group, The Waco Electric Corp., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.  
James A. Holscher, supervisor, advertising and public relations, Flight Publishing, Inc., Baltimore, Md.

Donald F. Tuck, managing director, new business and electronic products, General Electric Co., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.

William C. Wingo, manager, technical sales, Electronic Division, General Electric Co., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.

Robert E. Wingo, director, technical sales, Electronic Division, General Electric Co., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.

John F. Wingo, production manager, The Waco Electric Corp., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.

B. Wingo, sales manager, Electronic Division, General Electric Co., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.

James L. Wingo, general manager, The Waco Electric Corp., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.

William H. Wingo, chief development engineer, Electronic Division, General Electric Co., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.

John Wingo, national technical sales manager, The Waco Electric Corp., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.

Robert E. Wingo, chief development engineer, Electronic Division, General Electric Co., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.

Robert E. Wingo, chief development engineer, Electronic Division, General Electric Co., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.

Robert E. Wingo, chief development engineer, Electronic Division, General Electric Co., 2000 N. W. 10th Avenue, Fort Lauderdale, Fla.

## ENGINEERS

- Design • Research • Development
- Electrical Controls • Gearings • Bearings

Projects include constant speed drives, hydraulic motors, pumps and other components for commercial and military aircraft and missiles.

Send Resume and Technical Background Data to:  
SUNDSTRAND Personnel Dept., 1431 32nd Ave., Eastford, Ct.  
**SUNDSTRAND AVIATION**

This advertisement is under no circumstances to be printed or so often as to be in effect as a solicitation of an offer to let any of these contracts.  
The offering is made only by the Prospects.

NEW ISSUE September 15, 1978

\$10,000,000

## The Garrett Corporation

4 1/2% Subordinated Debentures  
Due September 15, 1978

Convertible into Common Stock on or before September 15, 1980  
at \$100 per share, subject to adjustments in certain cases.

Price 100%

(first annual interest from September 15, 1978)

This Prospectus may be obtained in any State in which this offering is conducted from only such of the underwriter or other dealers as are listed in any locality after their names in such State.

Marcell Lynch, Paine, Fennel & Smith

Wells & Co., Inc. The First Boston Corporation Grant, Ferguson & Co.

Marshall & Co. Harnett & Wicks Kohn, Probable & Co.

Lehman Brothers Smith, Barney & Co. White, Wolf & Co. Bear, Stearns & Co.

Hamill, Noyes & Co. E. F. Hutton & Company Price, Wether, Jackson & Curtis

Schwabacher & Co. Shields & Company







**Designed  
to encourage  
your creative process**

If you are a trained engineer or scientist seeking to apply your own imagination and ingenuity in developing advanced decision, control, or communication systems, you want conditions designed to encourage your creative process.

After conducting surveys at many locations, the Bendix Systems Division selected 50 acres adjacent to the Engineering campus of the University of Michigan as offering the best site for its new home and for creative work.

The Systems Division, serving as the focal point for systems planning within the Bendix Aviation Corporation, is housed in a new two-story structure. Equally divided between laboratory and office space, this modern building offers full facilities for encouraging your finest work.

The proximity of the University of Michigan, as well as Bendix's personnel policies permit you to attend day classes. The lovely town of Ann Arbor offers you the low-pressure life of a small town, combined with the cultural advantages of a large city.

For greater opportunity in weapon systems planning, research and development, along with more desirable living, you are invited to visit the Bendix Systems Division, Dept. A108, Ann Arbor, Michigan.



**Bendix Systems Division**

ANN ARBOR, MICHIGAN



## ASI ENGINEERS & SCIENTISTS

There is your opportunity to grow with a young, expanding company, of the Ford Motor Company. Outstanding career opportunities to engineers in Automotive's new RESEARCH CENTER, overlooking the Pacific at Menlo Park, and the facility in Glendale, California. You will have all the advantages of a stimulating technical environment, working with advanced equipment in a new facility, located where you can enjoy California living at its best.

**FOR AND BY RESEARCH SPECIALISTS** with 1 or 2 years experience in R & D in the field of automotive engineering, mechanical and chemical theories and characteristics, the work on electrical and experimental equipment related to power technology and advanced motor vehicles. Develop engineering concepts in a research facility with high test prices available under research or development contracts with original equipment manufacturers, such as Ford, GM, Chrysler, and others.

**PROGRESS ENGINEERS** with 3 years experience in R & D with solid background in electrical and mechanical engineering. To work on projects of your own in R & D in advanced systems in field of electrical engineering and for space program work.

**ADVANCED MECHANICAL ENGINEERS** with 3 or 4 years experience in R & D in the field of mechanical engineering. To work on projects of your own in R & D in advanced systems in field of electrical engineering and for space program work.

**STRUCTURAL ANALYSIS SECTION ENGINEERS** with 3 or 4 years experience in R & D in the field of structural analysis. To work on projects of your own in R & D in advanced systems in field of electrical engineering and for space program work.

**FLUID MECHANICS SECTION ENGINEERS** with 3 or 4 years experience in R & D in the field of fluid mechanics. To work on projects of your own in R & D in advanced systems in field of electrical engineering and for space program work.

**THERMODYNAMIC THEORY AND DESIGN ENGINEERS** with 3 or 4 years experience in R & D in the field of thermodynamics. To work on projects of your own in R & D in advanced systems in field of electrical engineering and for space program work.

**RESEARCH ENGINEERS** with 3 or 4 years experience in R & D in the field of research. To work on projects of your own in R & D in advanced systems in field of electrical engineering and for space program work.

**DESIGN ENGINEERS** with 3 or 4 years experience in R & D in the field of design. To work on projects of your own in R & D in advanced systems in field of electrical engineering and for space program work.

**QUALIFIED ENGINEERS** with 3 or 4 years experience in R & D in the field of engineering. To work on projects of your own in R & D in advanced systems in field of electrical engineering and for space program work.

**AERONAUTIC SYSTEMS, INC.**  
a subsidiary of Ford Motor Company  
1554 Air Way Blvd. 15 Glendale, California  
Glendale 2-4321

ANTHONY WEEK October 6, 1958

*An invitation  
to  
senior scientists  
and  
engineers*



A BROADBENT & B. Center, leading space laboratories, now located at one of Republic's \$25,000,000 research and development programs of recent construction by Stanley L. Pauls, President, and Alexander Kartov, Vice-President for Research and Development.

## ... To join Republic Aviation's new \$35 million Research and Development Program for spacecraft, missiles and advanced aircraft

In announcing Republic's \$35 million research and development program, designed to meet all major breakthroughs in the aviation industry's transition to astronautics, Stanley L. Pauls, President, set the following objectives:

"1. ACCUMULATION OF PROJECTS ALREADY UNDER WAY BY REPUBLIC ON LARGE PROGRAM FOR MANNED SPACE VEHICLES, AND MISSILES TO BRIDGE GROWING GAP, AND INITIATION OF INVESTIGATIONS LEADING TO NEW CONCEPTS FOR INTERPLANETARY TRAVEL."

"2. RAPID NEW FAMILIES OF LONG-RANGE AIR-TO-AIR MISSILES AND AIR-TO-GROUND BALLISTIC MISSILES FOR STRATEGIC AND TACTICAL AIRCRAFT."

"3. VERTICAL TAKE-OFF FIGHTER-BOMBERS, HIGH-MAKE FIGHTER-BOMBERS, AND SUPPORTING AIRCRAFT."

Alexander Kartov, Vice-President for Research and Development, emphasized that Republic's program "will not duplicate in any way investigatory work currently in progress elsewhere, but will stress novel concepts and new approaches to basic problems of missiles and space technology."

The program includes construction of a \$14 million R & D center to house 9 new laboratories, and anticipates doubling the present research staff.

Senior men interested in the new possibilities created by a simultaneous employment of all aspects of Flight Technology are invited to study the freedom of the new laboratories for more detailed information.

### HEAT ENGINEERING AND POWER LABORATORY

To develop new heat engines and new fuels, and to develop and improve engine and propeller systems, and to develop and improve engine and propeller systems.

### FLUID MECHANICS AND AERODYNAMICS LABORATORY

To develop new fluid mechanics and aerodynamics, and to develop and improve engine and propeller systems, and to develop and improve engine and propeller systems.

### STRUCTURAL ANALYSIS LABORATORY

To develop new structural analysis and to develop and improve engine and propeller systems, and to develop and improve engine and propeller systems.

### DESIGN LABORATORY

To develop new design and to develop and improve engine and propeller systems, and to develop and improve engine and propeller systems.

### RESEARCH LABORATORY

To develop new research and to develop and improve engine and propeller systems, and to develop and improve engine and propeller systems.

### ADVANCED FLIGHT SYSTEMS LABORATORY

To develop new advanced flight systems and to develop and improve engine and propeller systems, and to develop and improve engine and propeller systems.

### MANUFACTURING RESEARCH LABORATORY

To develop new manufacturing research and to develop and improve engine and propeller systems, and to develop and improve engine and propeller systems.

Qualified men are invited to write directly to:  
A. Kartov, Vice-President, Research and Development



**REPUBLIC AVIATION**  
FARMERSDALE, LONG ISLAND, NEW YORK

## New Opportunities for SYSTEMS ENGINEERS and MECHANICAL ENGINEERS

with 2 to 7 years' experience  
(EE, ME, AE or Physics)

These positions are with General Electric's Ordnance Department, contractor for some of the most complex weapons systems ever conceived—including POLARIS project fire control and guidance systems and TALOS handling and launching equipment. Based in Pittsfield, Massachusetts—heart of the Berkshire Endings and along country—the Ordnance Department offers professional advancement a wider and more inviting horizon.

### INTERMEDIATE OPENINGS IN THESE AREAS:

- Systems Development, Design and Development
- Fire Control Engineering, Surface and Missile
- Electronic Circuit Development
- Inertial Guidance
- Field Service and Installation
- Reliability Engineering
- Field Testing

(openings in Florida and California)

Send resume in confidence to:  
Mr. W. R. Finkler,  
Dir. 56-W-X  
ORDNANCE DEPARTMENT  
**GENERAL ELECTRIC**  
Pittsfield, Mass.



**MARQUARDT**  
*Professional Personnel  
Recruitment*

**AERODYNAMICIST**  
*Internal Flow Systems*

To formulate and test axial systems and test models for supersonic air breathing propulsion systems. Candidates are required to be experienced and capable design engineers. Experience with design and development of systems for jet and ramjet engines is essential.

Five years' experience in internal flow and fluid dynamics analysis. Experience in aerodynamic design and development of axial systems with appropriate advanced study.

Good work group often moved to personally for professional recognition and advancement.

Write: Mr. Dale Mangan, Personnel Manager, Marquardt Aircraft Co., 10000 Wilshire Blvd., Los Angeles 40, California.



**marquardt** aerotech

## New "EMPLOYMENT" Advertisements

received by 10 A.M. Oct. 10th  
will appear in the Oct. 20th  
issue, subject to space limitations.

## AVIATION WEEK

Classified Advertising Division

P. O. BOX 12  
NEW YORK 36  
NEW YORK

## FOR RATES OR INFORMATION About Classified Advertising

Contact  
*The McGraw-Hill Office*  
Nearest You

ATLANTA, 3  
1301 Rhodes-Henry Bldg.  
Jackson 2-8951  
R. H. KOTTEL

BOSTON, 16  
330 Park Square  
MUSBORO 2-7160

CHICAGO, 11  
330 N. Michigan Ave.  
WICHITA 4-5800  
W. J. HODGSON R. C. JACKMAN

CLEVELAND, 13  
55 Public Square  
COLUMBUS 1-7000  
W. A. SCHWARTZ F. A. ROBERTS

DALLAS, 2  
1712 Commerce St.  
Wynham Bldg.  
DINWIDDIE 7-5117  
DOROTHY JONES F. A. HODGSON

DETROIT, 36  
856 Penobscot Bldg.  
WINDSOR 2-1793

LOS ANGELES, 17  
1133 W. 6 St.  
HOLLYWOOD 9-5450  
R. L. HODGSON

NEW YORK, 36  
300 Fifth Ave.  
COLUMBIA 5-5929  
D. T. COSTER R. F. JARVIS

PHILADELPHIA, 3  
17th & Sansom St.  
BIRNBAUM 6-0470  
H. W. ROBERTS

ST. LOUIS, 8  
2615 Olive St.  
JEFFERSON 5-4567

SAN FRANCISCO, 4  
68 Pine St.  
DOUGHERTY 2-4600  
W. C. WOODSON



What it's like

to be a Creative Engineer at

# IBM



**INERTIAL GUIDANCE ENGINEER** John V. Prikazsky tells why airborne computer development at IBM Oesgo, N. Y., offers him the creative engineering career he always wanted.

"Inertial guidance" explains John Prikazsky "means aerial navigation without recourse to external reference. As an inertial guidance engineer with IBM, I have the opportunity to work on completely integrated bombing radar navigation systems. My work is broad — from lab studies to the analysis involved in system design — everything from shooting the North Star to heat transfer problems. That's why I like it — plus the chance I have to take on as much responsibility as I can handle."

### Other challenging assignments at IBM Oesgo

- Airframe scaling and digital computer systems
- Radar circuits and systems
- Guide and systems
- Optics
- Test equipment development
- Radar circuit and systems
- Translator circuit designs
- Magnetic Engineers

### Qualifications

B.S. or M.S. degree in electrical or mechanical engineering, physics or mathematics, and

Proven ability to assume a high degree of technical responsibility in your sphere of interest.

For DETAILS, just write, outlining background and interests, to:

Mr. P. E. Drake, Dept. 824W  
Military Products Division  
International Business Machines Corp.  
Oesgo, New York

IBM, a recognized leader in the electronic computer field, offers a stable balance of military and commercial work. You will find ground floor opportunities for professional achievement at IBM Oesgo. Liberal company benefits add steadily for industry today and salaries are commensurate with your abilities and experience.



### MILITARY PRODUCTS

ALSO CONSIDER:  
ELECTRIC ENGINEERING  
ELECTRONIC ENGINEERING  
MECHANICAL ENGINEERING  
OPTICS, GUIDANCE, MEASUREMENT  
SYSTEMS  
TEST EQUIPMENT

Florida and International Division, Burlington, Ontario, Canada, Progressive Technology, R. F. Longdon, Rg., Boulder, Mass., San Jose, Calif.





## MAY THEM



**SPARROW III**—the Navy's second Sparrow, also built under license by the British, is being used by Navy fighter aircraft to test its defense. Sparrow III is a four-engine white aircraft.



**NAWE**—the Agency's defense against low-ability offenders—carves out its destination in the blind zone of conventional codes. Head development and evolution is under Bayesian active control.



**TARTAN**—A submarine searchlight (SL) developed by the Navy Electronics Research Model is being developed. This equipment is a modernized and associated with model 2 is "but



**ADVANCED PROJECTS** is responsible for design as well as on-site guidance and control of the underway in-flight experiments. Nine facilities are currently being utilized for the work.



**PRELIMINARY NEW HIRSH** of tomorrow's stock rally will result from the rebounded stock action done by today's market-suspense. Northeast plays on Thursday will be in the news.

### Raytheon diversification offers

## JOB STABILITY FOR CREATIVE MISSILEMEN

Here is an opportunity to free yourself of worry about a job that's been lacking. [www.humanities.com](http://www.humanities.com)

**Diversified assignments**—only possible in a company with Raytheon's wide range of missile activities—ensure security not found in one- or two-project companies. You apply your creative energies to the many projects you work on, and they in turn use your "insurance" second before into a red.

Individual recognition comes quickly from Raytheon's young, engineer management—men who are keenly aware of the engineer's needs and contributions to overall progress.

**Dynamic** Raytheon growth—the fruit of this metropolitan's progressive policies—is best illustrated by the fact that Raytheon is already the only electronics company with two prime missile contracts—Navy Source III and Army Hawk.

The next step is up to you. Why not get frank answers and helpful information on the type of job suited to your background and talents, its location, salary and other important details. Write, wire or telephone collect. The number is CHestnut 4-7500 in Bedford, Massachusetts. Please ask for J. Clive Ross.

**SAYEDON OPPORTUNITIES NOW OPEN IN:**

WEAPONS SYSTEM ANALYSIS • CONTROL SYSTEMS  
PACKAGING • MICROWAVE • RADAR • SPECIFI-  
CATIONS • MISSILE AERODYNAMICS • WIND TUN-  
NEL TESTING • AERODYNAMIC HEATING • ROCKET  
ENGINEERING • VIBRATION MEASUREMENT and  
DATA REDUCTION

**RAYTHEON MANUFACTURING COMPANY**  
Missile Systems Division, Bedford, Mass.



## ADVERTISERS IN THIS ISSUE

AVIATION WEEK OCTOBER 6, 1952

[illegible]

world's the leader of the future of H&amp;M.



**TEST  
EQUIPMENT  
ENGINEERS**

If you've been looking for an opportunity to explore new engineering territory, the positions now open in our electronics test equipment group may be right down your alley.

We need engineers to do research and development based on an entirely new electronics test equipment philosophy. Briefly, the job involves design of test equipment and analysis of electronic designs submitted by vendors and subcontractors. This is one phase of our work on advanced weapon systems B-70 and F-302.

For more information please write to: Mr. A. K. Steinhart, Engineering Personnel, North American Aviation, Inc., Los Angeles 15, Calif.

\* 资料来源：根据《中国统计年鉴》整理。

**NORTH  
AMERICAN  
AVIATION, INC.**







**How to start an Industrial Revolution.** Avco's Lycoming engineers have done it, with a new idea in power. Gas turbine power . . . rugged, lightweight, mobile, and amazingly versatile. Already in production for aircraft, Lycoming turbines are adaptable for boats, heavy trucking, for hundreds of uses. Look to Lycoming turbo power to create new industries, new strength for America.

# Avco